

JPRS-TND-87-012

19 JUNE 1987



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JPRS Report

Nuclear Developments

19 JUNE 1987

NUCLEAR DEVELOPMENTS

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CANADA'S STAND ON INF ISSUES DISCUSSED

Clark Interview

Toronto THE GLOBE AND MAIL in English 1 May 87 p A5

[Article by Jeff Sallot, Ottawa]

[Text]

Western European allies should not choke off the possibility of a nuclear arms control agreement between Washington and Moscow at an early stage, External Affairs Minister Joe Clark says.

There is Canadian concern that Western European attitudes might be an obstacle to an arms-control deal between the two superpowers, Mr. Clark said in an interview yesterday.

There has been a lot of progress by the United States and the Soviet Union in arms talks on the possibility of eliminating medium- and short-range nuclear missiles based in Europe, he said.

The Soviet and U.S. proposals are "serious and significant."

But some of the allies have expressed alarm that elimination of the missiles could weaken U.S. resolve to use the U.S.-based strategic nuclear forces in defence of Western Europe.

"We can't allow a process which has involved this much movement by the superpowers to be frustrated at the beginning by some understandable but surmountable differences within the alliance," Mr. Clark said.

Western European governments are generally aware that there would be unfavorable consequences if they were identified as the reason

why progress was not made, he said.

The allies have an obligation to try to resolve their differences of opinion on the issue soon enough to allow President Ronald Reagan sufficient time to negotiate a treaty, Mr. Clark said.

Mr. Reagan's term of office does not expire until January of 1989, but most diplomatic and political observers say his effectiveness in the field of foreign policy diminishes as the 1988 fall election approaches, Mr. Clark said.

He is optimistic that the allies will resolve the issue among themselves before this fall.

Mr. Clark announced yesterday that he is adding a stop in West Germany to his visit to Europe, which begins on Sunday.

He will meet West German Foreign Minister Hans Dietrich Genscher on May 9 and 10. The arms-control issue and the possibility of further economic sanctions against South Africa will be among topics for discussion.

Mr. Clark begins his tour in Poland, where the agenda includes talks with Polish officials about their intentions for debt repayment to Canada.

He will be in Berlin on Wednesday and Thursday. That city is marking its 750th anniversary this year.

Mr. Clark will spend three days in Hungary, where there will be a range of discussion subjects, including trade and commercial relations.

Ottawa THE OTTAWA CITIZEN in English 18 Apr 87 p B2

[Editorial: "At Last, Nuclear Arms To Decline"]

[Text]

Prospects for the first-ever nuclear reduction treaty have never been brighter. Even the usually dour U.S. State Secretary George Shultz is optimistic about an early accord following his Moscow visit.

The upbeat mood in U.S.-Soviet relations — despite the recent revelations about embassy eavesdropping and sexual entrapment — reflects the real progress made at the Reykjavik summit and since on the elimination of intermediate-range nuclear forces (INF) from Europe.

Both sides now agree that all Euromissiles of medium-range (over 1,000 kilometres) should be removed from NATO and Warsaw Pact territory within four to five years. The Soviets will be allowed to retain 100 in Soviet Asia and the Americans 100 in the U.S.

Still to be negotiated are the precise verification measures to be incorporated in an INF treaty. But Mikhail Gorbachev agreed with Shultz that these must be both strong and intrusive. The U.S. inspection blueprint has already been tabled in Geneva. Soviet ideas will be unveiled there next week.

The issue of shorter-range missiles (SRINF) in Europe — those with a range of 500-1,000 kilometres — was also addressed at the Moscow talks. Following his offer last week in Prague to negotiate their reduction, Gorbachev told Shultz he was willing to eliminate all of them within one year if the U.S. did likewise.

The state secretary promised to present this proposal to his NATO allies. He started the consultation process Wednesday at a meeting in Brussels of NATO foreign ministers, including External Affairs Minister Joe Clark.

While there is some reluctance among West Europeans, particularly West Germans, about NATO's agreeing to a nuclear-free Central Europe in the face of Soviet conventional military superiority, the obvious popular attraction of such a result bodes well for its eventual acceptance.

The fear of "decoupling" the U.S. from the nuclear defence of Europe is the main argument against INF and SRINF agreements to eliminate all Euromissiles. Yet this can be readily countered. Apart from the 300,000 American soldiers still stationed in Europe, American nuclear-capable aircraft based in Britain, the untouched British and French nuclear forces and U.S. nuclear-armed submarines and ships would still be in the area.

The significance of a European nuclear reduction accord would be far greater than the number of warheads and carriers affected would indicate. It could lead to much greater confidence, a superpower summit, progress on reducing strategic nuclear forces and even conventional force reductions.

It is now clear that Gorbachev wants to reduce his nuclear burden. NATO should help him do so provided Western security can still be maintained.

CITIZEN 24 Apr Editorial

Ottawa THE OTTAWA CITIZEN in English 24 Apr 87 p A8

[Editorial: "Politics of Arms"]

[Text]

NATO would place itself in an impossible position if it were to reject Mikhail Gorbachev's offer to eliminate intermediate-range nuclear missiles from Europe and refuse to consider his suggestion that even shorter-range ones be removed. Yet that's exactly what the retiring military commander of the Atlantic alliance, Gen. Bernard Rogers, recommends.

Doubtless it makes military sense for NATO to retain some nuclear weapons in Europe to offset the superior Soviet conventional forces there. The doctrine of flexible response remains NATO policy.

What the supreme allied commander deliberately ignores, in a "secret" analysis being considered this week by NATO, is the political need for Western governments to respond positively whenever there's a chance of reducing reliance on nuclear weapons.

The Western public mood senses that there is now an opportunity that didn't exist in 1979 when NATO governments, led by West Germany, decided to offset the new threat posed by the deployment of Soviet SS-20 missiles.

Two years later, NATO endorsed President Reagan's zero option proposal to eliminate all Euromissiles from both sides of the European theatre. Now that Gorbachev has at last accepted the same zero solution, NATO really has no choice but to pocket the Soviet move.

Rogers criticizes the idea of taking out all INF missiles from Europe at this time. But his advice is purely military. He knows that NATO governments are not prepared to spend more on conventional arms to bring theirs up to the same levels as the East's. But he conveniently overlooks the continued presence of U.S. forward-based aircraft, submarines and ships available to the European command, all nuclear-capable.

Rogers goes even further in response to Gorbachev's second zero-option offer about scrapping all shorter-range nuclears. The general not only opposes this but he reportedly recommends that the U.S. deploy short-range missiles of its own on European soil.

A military commander usually tries to overcompensate. But the responsibility of elected governments is to determine the lowest common denominator of military force required consistent with the maintenance of security and balance.

Since NATO itself initiated the move to do away with all INF weapons from Europe, it has no choice but to continue with that policy. How could we explain departing from it now, just because the Soviets offer to throw all shorter-range missiles into the pot?

The new issue posed by Gorbachev's latest offer demands careful military and political consideration by NATO. But the "old" INF deal must now be signed, sealed and delivered to a public that has waited too long for it, Rogers notwithstanding.

CITIZEN 25 Apr Article

Ottawa THE OTTAWA CITIZEN in English 25 Apr 87 p B6

[Article by George Grande: "Anything Seems Possible in European Arms Talks"]

[Text] These are crucial days for military disarmers as the Geneva talks resume in an atmosphere of hope.

Big things are going on between the superpowers and among European nations. The skill with which they are managed will determine whether they prove dangerous or helpful for lasting peace.

The most eye-catching potential development lies in the field of nuclear arms reduction. Ever since last October's Reykjavik superpower summit, it's been a new game with new proposals and variations surfacing nearly every week.

The net result could be a nuclear-free Europe to begin with — or almost one. Such a possibility a year ago would have been laughed out of court. Now it's talked about in both NATO and Warsaw Pact circles with increasing frequency.

There are now actually four broad types of nuclear weapons in Europe being discussed. Up to a short while ago, there were only two. At Reykjavik, only one was seriously addressed.

This was what NATO calls intermediate-range nuclear forces (INF). They have a range of over 1,000 kilometres and some up to 3,000. Between them they can reach all the capitals of both alliances on the continent. They include on the allied side U.S. cruise missiles stationed in Britain, Belgium, West Germany and Italy and Pershing 2s deployed in Germany.

On the Warsaw Pact side, they mean Soviet SS-20 missiles (with triple warheads), and SS-4s. All of these could constitute the core of the first nuclear reduction treaty ever. The basics — total removal from Europe on both sides with 100 remaining in Soviet Asia and 100 in the U.S. — have already been agreed. Verification details remain to be settled.

The second category has been much in the news of late. It comprises shorter-range, intermediate-range forces (SRINF) having a range of 500 to 1,000 kilometres.

The Soviet ones include SS-23s and SS-12/22 Scaleboard missiles. The U.S. Pershing 1s in Germany are the only deployed NATO weapons in this general category.

Soviet leader Mikhail Gorbachev surprised Secretary of State George Shultz in Moscow a week ago by proposing that all of these be removed within a year. But he wasn't very specific about what he included in his definition of shorter-range. By inference he may have also been talking about the other two categories.

The third is that of battlefield missiles that can be either nuclear, conventional or chemical. These are Soviet SCUDs, SS-21s and FROGS, matched by NATO's Lance missiles (and the French Plutons). The prospect of eliminating all of this sort is causing European NATO members some anxiety and soul-searching.

Finally, there are other tactical nuclear weapons such as bombs and artillery shells that haven't yet been discussed in detail by the two sides. But if Gorbachev really means what he says, they should all go as well. He suggested in Prague the eventual elimination of what he called "operational-tactical" missiles, probably meaning those in the third category. But he also mentioned doing away with "tactical nuclear weapons," which could include everything that remains.

Many Western analysts believe that the Soviet leader has decided that all nuclear weapons must be discarded because, the speculation goes, he is convinced that a nuclear war cannot be won by either side, no matter how it starts.

For that fundamental reason, he is giving top priority to the question, "How can this be brought about?" He told a neutral statesman recently that he intends "to bombard the West" with all kinds of proposals in an intensive effort to achieve his nuclear-free objective.

He is realistic enough to realize that the problem must be attacked progressively. Therefore he chose INF for starters and had no trouble at all in reversing his own policy that previously had linked INF reductions to an agreement on Star Wars.

Even before an INF pact was signed, Gorbachev couldn't resist throwing SRINF into the pot and broadly hinting that battlefield missiles and even more were also negotiable to zero. In fact Reagan's "zero option" proposal appealed so much to the Soviet leader that he took it over as his own — and doubled it.

On the European defence front, West Europeans are slowly realizing that the U.S. won't stay in Europe forever and that nuclear weapons won't either. A Southam correspondent James Ferrabee recently put it, the problem is "determining how Western Europeans can arm and defend themselves in a Europe without nuclear arms and where the U.S. slowly withdraws not only its nuclear missiles, but also its 350,000-odd troops."

The beginning of Europe's answer may lie in the revival of the seven-nation Western European Union that is meeting in Luxembourg next week. But that is another story.

So too is that of the Common Market's negotiating with the Warsaw Pact's economic arm, the Council for Mutual Economic Assistance (CMEA), to establish official relations. Such a possibility was inconceivable a few years ago.

The exciting news, though, is about nuclear arms reductions. The momentum is so strong that it won't go away until it's resolved one way or another. Ask any European — or his wife.

(George Grande, a former Canadian ambassador, is now a member of the *Citizen's* editorial board.)

REPORT SAYS CANADA ILL PREPARED FOR NUCLEAR ACCIDENT

Ottawa THE OTTAWA CITIZEN in English 25 Apr 87 p B6

[Article by Margaret Munro]

[Text]

The Canadian government was ill-prepared to handle the Chernobyl nuclear disaster that spewed radiation around the world, says a federal report.

The report, written for Health and Welfare Canada, says the bureaucracy is so ill-prepared to deal with disasters that a new "swat team" is being organized which will be sent to any federal agency involved in an emergency.

Dr. Alan Prince, former president of the Atomic Energy Control Board, lays out 24 recommendations in his report to ensure the government is better prepared for nuclear accidents.

Most of the recommendations deal with the need to improve execution of the federal Nuclear Emergency Response Plan.

Full-dress rehearsals of the plan should be held regularly to eliminate the problems the developed between government departments in the aftermath of Chernobyl, says Prince, who suggests rehearsals be held every six months.

He also says Health and Welfare Canada, the lead federal agency for nuclear emergencies, needs a "war room" with updated communications systems if it is to continue to be in charge of handling such disasters.

After the Chernobyl accident, the phone lines at Health and Welfare were so jammed that telephone contact with the main players was "virtually impossible."

And while Health Minister Jake Epp was quick to assure the public that every precaution was being taken, it took several days for food inspectors to get instructions needed to live up to Epp's earlier promise that no radioactive food would be allowed into Canada.

Communicating with an alarmed public was the government's biggest problem.

More than 5,000 calls were made to Health and Welfare, which was so overwhelmed that it hired students to answer the phones — all of which infuriated many callers since the students had "essentially no knowledge of radiation matters."

Environment Canada's weather offices across the country received an estimated 50,000 calls regarding Chernobyl.

The 29-page report recounts at length the problems Chernobyl generated in government and says that while many bureaucrats were aware of the problems, the health minister was oblivious to the confusion.

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CSO: 5120/8

ARMS CONTROL CENTER AGAINST NUCLEAR SUBMARINE FUNDING

Ottawa THE OTTAWA CITIZEN in English 30 Apr 87 p A11

[Text]

Canada would be wasting its money by buying a fleet of nuclear-powered submarines to patrol the Arctic, says a leading Canadian arms-control think tank.

The Canadian Centre for Arms Control and Disarmament briefed reporters on Wednesday on its views about a proposal being discussed by cabinet to buy as many as 10 nuclear submarines that would be deployed defending Canadian sovereignty in the Arctic.

John Lamb, centre director, said submarines would be unseen and therefore have little visible effect when it comes to asserting sovereignty.

And in peacetime they would have few options when they do meet another submarine, other than to alert headquarters.

"With submarines there is no equivalent to a warning shot across the bow," Lamb said.

The centre, an independent, non-profit organization that studies international military and arms-control issues, is worried that the government will decide to buy the submarines, and that the costs will be unreasonably high.

The whole project, which could involve building new submarine pens on the east and west coasts, would also require construction of facilities to handle nuclear fuel.

The whole package could cost \$10 billion, Lamb said, about double the number being floated by the government. External Affairs Minister Joe Clark confirmed on Tuesday that the purchase of nuclear submarines is under consideration by cabinet.

The centre argues that defence and sovereignty needs are better served by the purchase of diesel-electric submarines and passive detection devices.

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CSO: 5120/8

JAPAN ADOPTS CURB ON NUCLEAR WEAPONS TECHNOLOGY EXPORTS

OW161927 Tokyo KYODO in English 1209 GMT 19 Apr 87

[Text] Tokyo, April 16 KYODO -- A panel of seven major industrialized democracies has agreed to curb exports of high technology and related equipment used in the production of nuclear weapons to other countries, the government announced Thursday.

The agreement is said to be aimed at banning nonnuclear powers from attempting to produce nuclear weapons and strengthening the system set among the countries seeking to prevent nuclear proliferation.

The 18-point guidelines worked out by the seven powers include rockets capable of carrying hardware weighing more than 500 kilograms and related production equipment.

The international agreement was simultaneously announced Thursday by member nations which include the United States, Britain, France, West Germany and Japan.

Software such as flight control systems as well as aero-electronic devices used for rocket production are also on the list.

Regarding nonrestricted software for export, Japan will ask countries involved not to put them into use after modification or remodeling.

Japan will also seek guarantees from member countries to refrain from re-exporting the high-technology to third countries without Japan's consent, government officials said.

Japan is expected to call on the Soviet Union and China to join the international accord, the officials said.

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CSO: 5260/92

REPORTS ON THEFTS, CRIMES AT KOZLODUY NUCLEAR POWER PLANT

Militiamen's Duties Described

Sofia NARODEN STRAZH in Bulgarian 29 Apr 87 pp 1, 4

[Leading article: "Bravery-Fraught Days and Nights"]

[Text] There are many routes by which we could have set out on this First-of-May trip of ours. And any of them would have brought us among outstanding industrial workers, people creating goods, militiamen vigilantly guarding them.

But we set out northwards, to Kozloduy, the rapidly pulsating heart of the Atomic Energy Combine.

However well known it may be, we are tempted to emphasize once more that the Kozloduy KAE [Atomic Energy Combine] is a project of the utmost importance for the present and future development of our economy. At the moment four 440-megawatt power blocks are in operation here. They produce over 34 percent of the total electric power output in the country. Two other 1000-megawatt power blocks are now under construction. One--power block No. 5--is to come on stream by the end of 1987, while the commissioning of No. 6 is expected in 1989. In the Ninth 5-Year Plan the Atomic Energy Combine will deliver 40 percent of the total amount of electric power produced in the country.

This is what determined our route. We set out as well in order to tell about the selfless service, at times bordering on heroism, of the militia officials guarding this national project.

"They need high spirit and moral support," said the chief of the Vratsa OUMVR [Okrug Administration of the Ministry of Internal Affairs], Maj Gen Georgi Mutev. "Their makeup, for the most part, is young--both in age and in service. The militiamen live and work under very difficult conditions. . ."

And indeed we met young, energetic sentries, cleanly and neatly dressed, disciplined, performing patrol and sentry duty in regulation manner.

Everywhere one sensed already a preholiday First-of-May mood. Among the VM [not further identified; possibly volnonaemna militsiya, "civilian militia"] officials it was intensified by the results achieved last year as well as by

the recently reported 1987 first-quarter results. Their main mission was accomplished, namely, guaranteeing the reliable protection and self-defense of the project by the timely foiling of attempts by hostile and criminal elements to perpetrate economic and criminal offenses and other violations of the law.

Patrol and sentry duty is aimed at checking on the construction and installation elements, equipment, belongings and luggage brought in and taken out. These have to be accompanied by the appropriate documents. At the construction site the perimeter protective fence has not been completely finished and this creates additional difficulties. In these unfenced places there are flanking sentries in motion. They are made up of a militiaman, a firefighter and a detachment member.

Last year these patrols prevented dozens of attempts at the impermissible crossing of articles and belongings and at the bringing in of alcohol. And during the 1987 first quarter alone there were almost as many attempts as during the past year.

Constant front-rankers in the competition that is conducted are squad leaders Outstanding Worker-MSgts Nino Yotov, Todor Shuev, Svetlozar Georgiev, et al. Out of the SOT [not further identified] technicians, MSgt Boris Bozhkov is notable among the specialists for his training.

First in the campaign against criminal offenses are MSgt Mariya Tsepenisheva, shift front-ranker and veteran official MSgt Lyuben Georgiev, MSgt Yavor Nikolov, et al.

It is a pleasure to be able to point out the fact that more and more frequently young officials are taking their place in the first rank of militiamen with greater longevity and achieved successes. The names of Sr Sgts Borislav Mikhaylov; Khristo Kartselyanski, graduate of the VM School in Kazanluk with high distinction; Gulubin Khikov, likewise a highly distinguished graduate of the school; and Zhivko Lilov compel recognition. Sr Sgts Mitko Krustev, Tsvetan Simeonov, Tsvetomir Madzharov, Ivan Benovski, and many, many others besides made a good showing in the competition.

In our conversation Lt Col Vasil Manoev, deputy NM [People's Militia] chief of the Kozloduy RUMVR [Rayon Administration of the Ministry of Internal Affairs], dwelt on the decisive role of unity of action between VM personnel and other rayon administration officials. This is especially strikingly expressed in the daily contacts of the economic operatives Sr Lt Mikhail Stoyanov and Capt Vasil Zakhariev, the OR [operativen rabotnik; operative] for criminal matters Sr Lt Lyudmil Yakimov, the rayon inspector Capt Valeri Nankov, senior motor-vehicle controller St Lt Venko Yotov, et al. They were present at the instruction sessions, acquainted the VM personnel with the distinctive features of the operational situation and set concrete problems. On their tips, for example, the militiamen of Maj Lyuben Pepelyarski's platoon in only 10 minutes apprehended a person who had illegally made off with a vehicle, and a citizen who had made an attempt to violate a woman's honor was speedily tracked down.

The OR's for economic matters make especially active use of the abilities of VM personnel in the campaign against pilferage and wastefulness. The militiamen give them tips about such cases which they refer to the councils on prevention. Most effective in this regard are Sr Sgt Yakov Nikolov and squad leader MSgt Svetlozar Georgiev.

The makeup of the VM protecting the Kozloduy Atomic Energy Combine is large and heterogeneous. Twenty-four-hour patrol and sentry duty is performed, depending on the situation. This handicaps the militiamen who live in conurbations at a distance from the combine, and some even come from the territory of neighboring okrugs. Therefore, together with Capt Valeri Nankov, party secretary, and Capt Petur Gogoshev, deputy chief of political education work, we are trying to find a place for individual political education work with each official.

"Due to the ban on personnel turnover and the quitting of VM ranks by some still unseasoned militiamen due to the especially difficult working conditions, we are confronted with many important problems," Captain Nankov emphasized. "We strive to impress upon everybody that the interests of the service must come first and that no lowering of the unit's combat capacity must be permitted."

"But at the same time," added Captain Gogoshev, "we are taking thorough pains with every militiaman. . ."

And, indeed, the administration cannot help on this score. A fight is being made for every militiaman. Various measures are being organized to harden the personnel, to elevate their ideological and professional training, to augment their knowledge about the nuclear processes taking place in the power blocks, to provide interesting pastimes, etc., etc. Various initiatives are being taken by the party and Komsomol organizations. For example, at their suggestion during the night tea and coffee are distributed to the sentries. A trifle perhaps, but they are all very grateful for a warm mouthful of liquid in the chilly night.

To this concern the militiamen have responded forthcomingly. Still talked about with emotion is the entire personnel's readiness, in response to the appeal of the party and Komsomol organizations, to provide four unpaid additional sentries during the repair of the hot channel. This continued day and night for nearly 2 months--outdoors, in rain, mud, snow, in very low air temperatures.

Instances of the smashing up of the trailers in which the workers lived increased in frequency. The party group in the third platoon appealed to the entire platoon to provide additional duty details without compensation. And on the third night the saboteur was caught.

. . . The atom has not been extinguished. And neither can anybody extinguish the enthusiasm and dedication with which the VM militiamen at Kozloduy Atomic Energy Combine perform their duty in order to ensure reliable protection and self-defense of the project. Together with the workers who continue to build

the First Atomic Power Plant, they constantly heighten their vigilance and make ready to greet the First of May worthily.

Soviet Specialist's Advice

Sofia NARODEN STRAZH in Bulgarian 29 Apr 87 p 1

[Article by Izrail L'vovich Sapir, head of Soviet specialist group working at Kozloduy Atomic Energy Combine: "Protection of Nuclear Equipment in Sure Hands"]

[Text] At the Kozloduy Atomic Energy Combine there is equipment worth hundreds of millions of leva. Our further work and the operational reliability of nuclear technology depend on its complete serviceability

We are grateful to all the militiamen of the NM [People's Militia] and to those in charge of them for the peacefulness they assure us. We are grateful also to the chief of the Vratsa OUMVR [Okrug Administration of the Ministry of Internal Affairs], Maj Gen Georgi Mutev, who frequently comes to see us and interests himself in our needs.

At this stage of the project thousands of instruments and various electronic devices are being delivered. They must be guarded against acts of sabotage and pilferage. There are unconscientious persons who deliberately break up sets and damage the instruments and devices. Explanatory work among the brigades working with the power blocks must be intensified in order to heighten everybody's vigilance. Members of DOT [dobrovolnite otryadi na trudeshtite se; volunteer detachments of workers] must be energized, and the capabilities of honest workers put to account to prevent such behavior.

Moreover, physical security does not fully measure up to requirements. I consider this question especially important and, if necessary, it must be raised at the highest level, but it must be solved without delay.

Security Guaranteed by Militiamen

Sofia NARODEN STRAZH in Bulgarian 29 Apr 27 p 1

[Article by Engr Zakhari Boyadzhiev, operations director of power block No. 5: "They Guarantee Us Peaceful Workdays"]

[Text] Plant security tasks are of the utmost importance. Unique equipment is being installed which must be well cared for and safeguarded against acts of sabotage and damage. Hence the great role played by VM personnel.

I want to note with satisfaction that the VM has always coped with its tasks. We meet with understanding at the RUMVR [Rayon Administration of the Ministry of Foreign Affairs]. We know that in difficult moments there is somebody we can count on and this imparts peacefulness to our workdays.

Militia Uniform Highly Honored

Sofia NARODEN STRAZH in Bulgarian 29 Apr 87 p 1

[Article by Ivan Stefanov, hero of socialist labor: "A Man in Uniform Is Highly Honored"]

[Text] At our project the militiaman's occupation is honored. There has been no instance of VM personnel's failing to respond to our calls. Even now I recall with what responsiveness a mixed detail (militiaman, firefighter and detail member) performed its duties recently under the especially difficult conditions in which the new power block--the new thousand megawatt, as we call it--was being installed.

I respect the militiaman's job. Everybody here knows me, but I always show the sentry my pass without a reminder. I do not know the name of a single one of them. But for me each one represents a generalized image of the man in uniform, the militiaman, to whom in case of need I can always turn for help and assistance.

6474

CSO: 5100/3014

SPECIAL MEASURING TECHNIQUES AT PAKS NUCLEAR POWER PLANT

Budapest ENERGIA ES ATOMTECHNIKA in Hungarian No 1, Jan 87 pp 36-41

[Article by Peter Galambos, graduate electrical engineer, and Laszlo Szabo, electric operations engineer, of the Paks Nuclear Power Plant Enterprise: "Special Measurement Technology Peculiarities at the Paks Nuclear Power Plant"]

[Text] 1. Introduction

A basic condition for the safe operation of a nuclear power plant at all times is reliable operation of the control technology systems. Controlling and monitoring the technological processes and maintaining and constantly ensuring nuclear safety are realized with the aid of extensive measurement, control, regulating, indicating, blocking and defensive circuits. The measurement circuits forward for the operating personnel the current values of the momentary states of the technological parameters.

The following characteristic parameters are measured at the Paks Nuclear Power Plant: temperature, pressure, pressure difference, fluid level, medium flow, vibration, movement, revolutions, acoustic signals, pH value, conductivity, concentration, moisture content, neutron flux and dosimetric factors.

The number of elements characterizing a nuclear power plant and the need for a uniform view and easier reviewability make necessary in the special area of control technology the use of a uniform alphanumeric indicator system in which we use the following Latin capital letters to designate the most important parameters:

- T--temperature measurement,
- P--pressure measurement,
- L--fluid level measurement,
- F--medium flow measurement,
- V--vibration, movement, revolutions, acoustic measurements,
- A--analytical measurements (pH, conductivity, concentration),
- M--moisture measurement,
- X--neutron flux measurement,
- R--dosimetric measurements.

In the alphanumeric system we group the measurements as follows according to where they are displayed and the function of the measurement circuit:

- 00X--measurements connected to a computer,
- 10X--block control room measurements,
- 20X--measurements going to the reserve control room,
- 30X--measurements for the joint operations control room,
- 40X--protective measurement circuits,
- 50X--measurement circuits producing blocking,
- 60X--measurement circuits going to local panels,
- 70X--measurements of regulatory circuits,
- 80X--on-site indicating systems.

From a number of viewpoints (e.g., form, structure, location and number) the control technology measurement circuits operating in a nuclear power plant differ from what is customary in traditional power plants. The most essential reason for the difference is that the technological processes of a nuclear power plant differ fundamentally from the technology of other plants. Because of the two cycle thermodynamic process, the hermetic separation of the primary and secondary cycles, and the large number of auxiliary systems to ensure safety the measurement circuits must be almost doubled.

Special measurements, the principle of "two out of three" to provide extra safety, the parallel protective systems and the measurement circuits connected to the information computer and the joint operations control room also increase the number of measurement circuits. So there are about 6,000 measurement circuits per block in a nuclear power plant.

2. Measurement Circuit Structural Peculiarities

About 3,000 remote transmitters operate in the level, quantity, pressure and pressure difference measurement circuits. In the case of the secondary cycle technological equipment the remote transmitters are located near to the equipment. The remote transmitters for the protective systems and primary cycle equipment are located separately in protected areas for radiation protection and safety reasons.

The pulse tubes, reference containers, sealing fittings and measuring orifices of measurement circuits connected to primary cycle technological equipment are made of acid resistant material to prevent corrosion products getting into the system.

Removing the air from and filling the pulse tubes in the primary cycle is done with blowback instead of blowing off as with other traditional technologies, as required to prevent radiation contamination of the environment.

The pulse tubes and reference containers are filled from a low and high pressure filling system (the NU system).

In Figure 1 one can see a diagram of the pulse tube connections of a remote transmitter for primary cycle pressure and pressure difference.

Manual valves located on the pulse tubes branching from the fill collector serve for filling or blow off in the manner which can be seen in the figure. The measurement orifices in the primary cycle are welded in to avoid the radiation danger deriving from possible leakage.

In the case of those measurement circuits which are connected directly to the primary cycle heat carrier systems there are outflow inhibitors built into the pulse tubes to prevent outflow of the primary cycle water.

In those measurement circuits where the signal coming from the remote transmitter in the uniform 0-5 mA signal range ... several ... [line appears to be missing] have been developed. The purpose of diode division is to ensure that the measurement circuit remains operational even in the event of a possible failure or break in the loads (indicating, recording instruments) on the circuit. Thus the secondary instruments are connected in parallel to the diodes making up the series circuit with the remote transmitter.

In the case of analog quantity and level measurement circuits an incidental error is introduced if the other parameters of the medium to be measured (temperature, pressure) deviate from the nominal value. Automatic pressure and temperature corrections are realized for the more important computerized measurements. It is very important from the viewpoint of controlling the block that the measurement results be displayed on a color TV screen. The measurement results appear projected onto technological schema on screens located in the block control room.

The measured parameters displayed on the screen can appear in three colors:

- the normal value of the parameter appears in green,
- a parameter value exceeding limit values is flashing:
 - red in the case of exceeding the upper limit,
 - blue in the case of exceeding the lower limit.

An "X" symbol on the schematic indicates the incredibility of the parameters.

The number of schematic images which can be called up is:

- 59 for the primary cycle schematic,
- 37 for the secondary cycle schematic.

For a few more important measurement circuits, in the start up, shut down and operational state, we measure a technological medium with several measurement circuits with different measurement limits in the interest of a suitably precise measurement of medium flow.

Here the Komplex Uran-2 [Complex Uranium-2] computerized process control system automatically switches to another measurement circuit when one measurement circuit is exceeded.

From the use viewpoint we group the measurement circuits into measurements providing information, indicating measurements, measurements producing blocking and measurements initiating protective intervention. The circuits for

protective purposes naturally require the greatest attention; these are also connected to secondary instruments. They form the following protective systems per block:

- reactor technological protection (hereinafter RTV I-II),
- zone breakdown cooling system (hereinafter ZUHR Y-X-W),
- block protection (B.V.),
- steam generator protection (G.F.V.),
- turbine protection (T.G.V.).

Of these special treatment must be given to RTV and ZUHR protection since these are special protective systems connected to the reactor.

3. Installation

Operational control of the nuclear power plant takes place from the block control room.

About two thirds of the measurement and control technology circuits feed into here. This is the central control room of the block from which we get an easily reviewed picture extending to everything concerning the status of the executing elements and the characteristic values of the current parameters of the primary and secondary cycles and the installed auxiliary equipment. The work of the operators ensuring continuous operation is aided by light and sound signals in the event of a state of any parameter deviating from nominal and by messages on the line printer of the information computer in the interest of keeping the given characteristics at the necessary and optimal values at all times. The most important measurements are displayed on the operations panels or consoles while those characteristics the reading of which provides information for which periodic checks are sufficient are placed on the non-operations panels, with the restriction that in the event of exceeding limit values they give an immediate call signal for the operator. In the case of those measurements where the magnitude and trend of changes in time must be noted or where it may be necessary to recall momentary values according to time the display is on recording instruments.

The work of the operators is also aided by an information computer installed separately from the block control room; this constantly checks the most important parameters and displays the monitoring and measurement results for the operator, directly on the operational panels, in a four color display on the schematics mentioned earlier independently from or in parallel with the circuits described thus far.

In the interest of increasing nuclear safety and making sure that the nuclear reaction taking place in the reactor can be monitored, kept in check, controlled and stopped at any time--even in the event of a catastrophe to the control center (block control room) or a breakdown for any other reason ("the dropping out of the block control room")--another control center, the reserve control room, is built parallel with but geographically separate from the block control room. The basic difference compared to the block control room is that control takes place from here only in the event of extreme necessity and in this case extends only to stopping the nuclear process and cooling the reactor.

For this reason its instrumentation is minimal; only the most important characteristics are displayed here.

Each of the blocks of the nuclear power plant makes up a coherent operating unit. But in the course of installation some auxiliary systems and equipment were set up jointly for two blocks.

These joint systems are controlled from the joint operations control room independently from the control rooms described above.

4. Measurement Circuit Connections of the Protective Systems

Operation of the protective systems is based on the principle of "two out of three" the basic concept of which is that if one measurement circuit or instrument fails protective action will not take place unjustifiably.

The two channel structure of the RTV and the three channel structure of the ZUHR system made it possible, in the case of an operating reactor block, to repair failures which may have occurred in the protective systems or, during tests, to have another parallel system, which is capable of taking care of the protective function by itself, in operation in addition to the system taken out of commission. A protective command has priority over manual and automatic control commands.

Protective operation is unidirectional; after it is started it cannot be stopped by manual intervention as long as the protective signal persists. The protective commands remain in effect as long as the parameter which started the protective operation exceeds the limit value.

4.1. RTV I-II.

The task of the technological protective system of the reactor is protection of the active zone, retarding the chain reaction in time or shutting it down in the event of definite technological parameters deviating to a greater degree than permitted. Protection goes into operation if the technological parameters reach or exceed previously set critical breakdown values. The improper operation of the reactor can be concluded from changes in the following parameters:

- the pressure of the primary cycle heat carrier,
- the pressure of the air space of the box,
- the speed of pressure changes in the primary cycle heat carrier,
- the hydraulic resistance of the active zone,
- the height of the water level in the volume compensator,
- the temperature of the primary cycle heat carrier,
- the neutron flux (reactor thermal output).

The following improper states also represent danger to reactor operation:

- the main circulating pumps stop (in part or all the pumps),
- the turbogenerators stop (one or both),
- the water level in the steam generators falls (feed pump failure or other cause),

--the pressure of fresh steam in the steam collectors falls with great speed,
--the control technology protective systems serving to protect the equipment are not operational.

The input signals coming from the measurement technology area are connected to the RTV through an appropriate relay logic. The intermediate and output relays of the protective system, the first failure indicating circuits and the step automatic circuits are fed by 220 V direct current. The other devices such as remote transmitters, recording instruments, synchronization monitoring and differentiating blocks require alternating current.

Both reactor protection channels are so built that there are three parallel (Y-X-W) measurement branches per channel for each of the measurement circuits measuring the same parameter.

This gives us a "two-channel two-out-of-three" principle. But the output relays of the channels operate common intervention organs.

The acceptance positions of the remote transmitters are so constructed that the Y-X-W branches are connected from take-offs from the given technology which are independent of one another, but the RTV-I and RTV-II channels and the Y-X-W protective circuits of the ZUHR are in contact with one another hydraulically. This interconnection in regard to level measurement in the volume compensator can be seen in Figure 2.

The remote transmitters of both protective channels are located in three hermetic remote transmitter sites of the primary cycle isolated from one another while the secondary instruments are installed in the appropriate Y, X, W branch panels of the control rooms.

The secondary instruments of the RTV I channel are located in the block control room while those of the RTV II channel are located in the reserve control room, and in their relay areas. The protective system gets input signals from contacts located on the secondary instruments.

If at least two signals from the three measurement circuits simultaneously reach the breakdown values set on the secondary instruments then the output protective relays go into operation on the basis of the "two out of three" logic and protection goes into effect. Figure 3 illustrates a block diagram of operation in the case of both protective channels.

4.2. ZUHR Y-X-W

The task of the zone breakdown cooling system is safe cooling of the active zone of the reactor in the event of possible run-off of the primary cycle heat carrier, as a cooling medium. The ZUHR protection differs from the RTV in that it is protection based on three separate mechanical units independent of one another each of which is capable of protective intervention independent of the others. Here the principle of "two out of three" is realized separately on the three (Y-X-W) protective channels.

As can be seen also in Figure 2 three each measurement circuits are connected separately to each ZUHR protective channel; the protection command is generated from these on the majority principle.

The location of the remote transmitters differs from the RTV in that here three each remote transmitters have been put in the remote transmitter sites of all three ZUHR branches. On the secondary side the registering instruments of all three branches are located in relay areas which are also geographically separated from one another. A block diagram of the measurement of a ZUHR branch can be seen in Figure 4.

5. Special Devices

The remote transmitters of the protective measurement circuits provide output signals in a uniform 0 to 5 mA signal range for the secondary instruments. But during continuous operation errors could occur in both the remote transmitters and the measurement circuits which would not cause protective action in the event of a failure within a single measurement circuit but it is immediately necessary to note them and correct them. A system checking the simultaneity of the measurement circuits notes and indicates such errors. The basis for its operation is that we connect in series with the analog output of the remote transmitter a two input L-02 type comparator (a device comparing analog signals) which compares the two input signals within certain limits and in the event of a deviation of them greater than plus or minus 5 percent gives a light and sound signal thus calling the attention of operating personnel to the error within the measurement circuit.

Its operation can be seen in the schematic of the RTV-I (Figure 3) where the L-02 located on the Y panels compares the Y and X branch signals, the L-02 of the X panel compares the X and W branch signals and the L-02 on the W panel compares the signals of the W and Y measurement circuits. The output signal of the comparator returns to its original state, following indication of a deviation, if the difference of the input signals balances out to at least plus or minus 3 percent.

A change of parameters with impermissible speed characterizes the failure of some technological equipment (e.g., a pipe break). Such protective input signals are generated in the event of a change reaching or exceeding, for example in the case of the RTV

$$\frac{dp \text{ collector}}{dt} > 0.46 \text{ bar/s.}$$

It is the task of the device to provide a 0 to 5 mA output signal proportional to the speed of change in the signal given to the input. This signal goes to the input of the recording instrument making up the protective contact.

During continuous operation the measurement circuits of the protective systems could fail also.

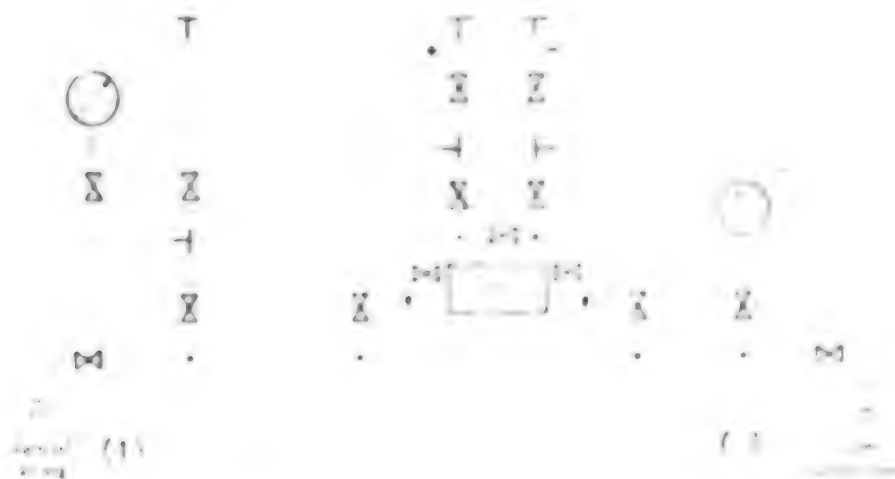
Regular checks, "cyclic protective tests," are made of the measurement circuits of the RTV and ZUHR protective systems in order to discover "hidden

faults" which do not appear during operation. During tests, using the ZU-05 current generators also shown on the block diagram and with the protective switch in the disabled "test" position, the indicator of the recording instrument making up the protective contact can be deflected in the direction of the protective limit value switch thus producing an actual protective input signal. When "sharpening protection" the output of the ZU-05 current generator is disengaged from the input of the recorders by the contact of the appropriate relay so that only the output signal of the remote transmitter reaches the recorder in an operational situation.

In this brief description we have tried to describe primarily the peculiarities which deviate from traditional technologies. We have shown the special measurement technology aspects of a nuclear power plant by selected examples--without trying to be complete--in the hope that our brief report will have achieved its goal and aroused the interest of the reader.

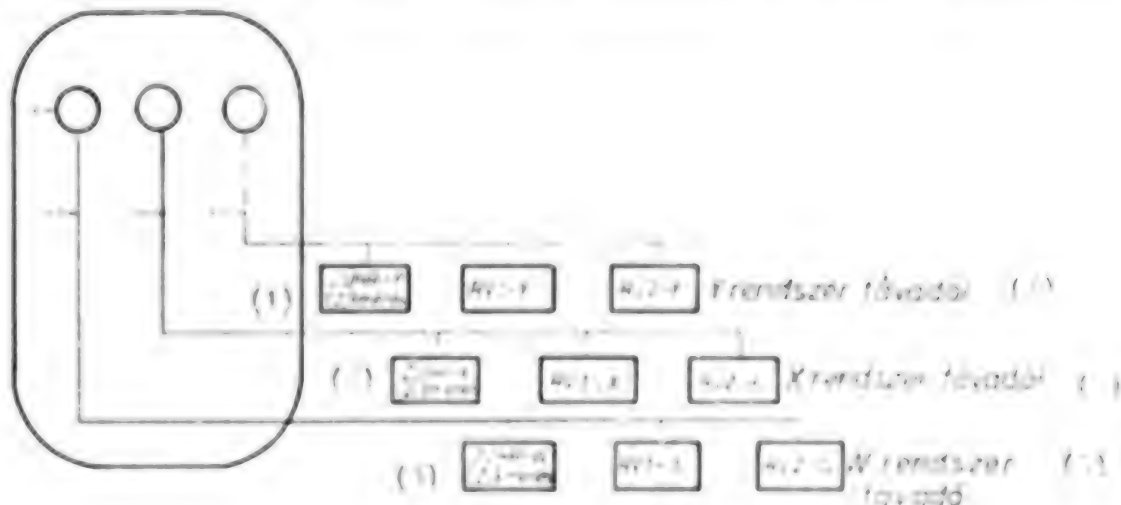
FIGURE CAPTIONS AND KEYS

Figure 1. Pulse tube connections diagram for remote transmitters.



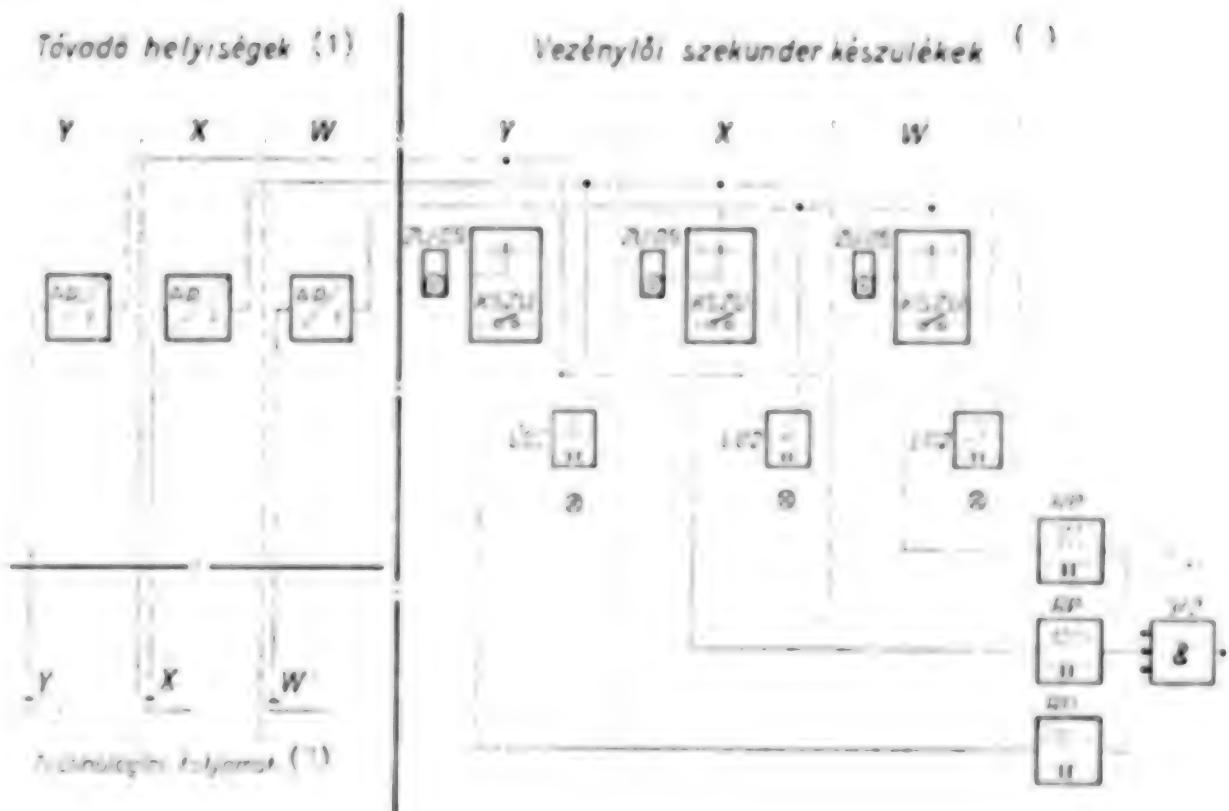
Key: 1. Filling Medium
2. To Special Channel

Figure 2. Connection of level remote transmitters to volume compensator.



Key: 1. ZUHR Y, measurements 1, 2, 3
 2. ZUHR X, measurements 1, 2, 3
 3. ZUHR W, measurements 1, 2, 3
 4. Y system remote transmitters
 5. X system remote transmitters
 6. W system remote transmitters

Figure 3. Block diagram of RTV I-II protective measurements.



Key: 1. Remote transmitter sites
 2. Control room secondary devices
 3. Technological process

ZUHR-Y távadó-helyiség (1)

1 mérés 2 mérés 3 mérés

AD 1 AD 2 AD 3

Techn.-i folyamat (3)

ZUHR-Y relé (2)

1 mérés 2 mérés 3 mérés

ZUOS 1 ZUOS 2 ZUOS 3

LO2 1 LO2 2 LO2 3

RP 1 RP 2 RP 3

3/2 8

8984
CSO: 5100/3014

NEUTRON FLUX MONITORING SYSTEM OF PAKS POWER PLANT

Budapest ENERGIA ES ATOMTECHNIKA in Hungarian No 2, Feb 87 pp 82-86

[Article by Zsolt Toth, graduate electrical engineer, and Zoltan Batai, electrical operations engineer, Paks Nuclear Power Plant Enterprise: "Description of the Neutron Flux Monitoring System of a VVER-440 Nuclear Power Plant Reactor Block"]

[Text] 1. Introduction

We can get the primary information about the momentary state of the chain reaction taking place in a nuclear reactor by measuring the thermal neutron flux reigning in the reactor.

The speed of alteration of the flux also carries important information in addition to the prevailing value of the relative neutron flux. We characterize the speed of alteration by the so-called period time.

Out of practical considerations we do not use absolute magnitude units when giving the magnitude of the neutron flux. Considering that there is a close correlation between the thermal output of the reactor and the average neutron flux we express the thermal neutron flux as a percentage of the nominal (100 percent) output established for the reactor.

2. Tasks of the Neutron Monitoring System (NER)

It is the task of the NER to provide information about the thermal neutron flux reigning in the active zone of the reactor and about the speed of alteration thereof.

The detectors sensing the flux are placed outside the reactor, so we are talking about a measurement external to the so-called basket (el-core).

The processed information is displayed on a TV screen on the operator's console in the form of a histogram and in numerical form on digital displays.

In addition to displaying the measured values the NER studies them further, generates warning, protection and other discrete signals and provides

information for the reactor output limiting (RTK) system, the block output control (BTSZ) system and the control and safety (SZBVR) system.

3. The Measurement Principle, Structure of the Detectors

The chief difficulty in measuring neutron flux in a reactor is the extraordinarily wide measurement range, extending from 10^{-10} percent to 110 percent. In absolute units this neutron flux corresponds to a range from about 0.1 to $1.2 \cdot 10^{11}$ neutrons per square centimeter.

The flux range embracing twelve orders of magnitude is covered by the NER broken down into measurement ranges. Thus the neutron flux can be monitored with suitable precision in every operational state.

The designation and measurement limits of the three measurement ranges are as follows:

source range: $10 \cdot 10^{-10}$ percent to $10 \cdot 10^{-4}$ percent
intermediate range: $10 \cdot 10^{-5}$ percent to 10 percent
energetics range: 3 percent to 110 percent.

The structure of the detectors sensing thermal neutrons is different in the several measurement ranges but the sensing principle is uniformly based on the nuclear physics effect of thermal neutrons. Since thermal neutrons are low energy, electrically neutral particles they have no direct ionizing effect. So the detectors are filled with materials the atomic nuclei of which are transformed by the slow neutrons, releasing from their nuclei strongly ionizing radiation in the process. By well known methods we transform the ionizing radiation into electric signals.

Since the chain reaction taking place in the reactor is also accompanied by strong gamma radiation we must distinguish the ionizing effect of this from the secondary ionization caused indirectly by the thermal neutrons. We call this the gamma background compensation of the neutron detectors; the method for this is different for the different types of chambers.

3.1 Structure and Operation of the Detection Blocks Used in the Source Range

The detection block type is BDPNZ-17. The housing of the block is made of stainless steel pipe to which are fastened insulating rings made of bakelite. At one end is a fitting serving to suspend it; this is insulated from the housing of the block. At the other end, to supply power to the block and provide for signal transmission, is the outlet for a KAGE type flexible cable with special radiation resistant organic insulation and triaxial shielding; to the other end of this are attached coaxial connectors to connect to the signal transformers.

The fission chamber itself, type KNK-15, is actually a gas dielectric (Ar, N, He) condenser on the armatures of which is a coating of pure U 235. The fission of the U 235 nuclei takes place when the chamber is radiated by thermal neutrons, and this is accompanied by secondary, strongly ionizing radiation. There is a 250 V voltage between the armatures. Current pulses

arise between the armatures as a result of ionization in the gas, primary ionization due to gamma radiation and secondary ionization as a result of neutron radiation. The strength of the current pulses produced by gamma radiation is substantially smaller than that of the pulses produced by the secondary ionization so the former can be filtered out simply by amplitude discrimination. Thus the gamma background radiation compensation of the source range detectors is solved.

The output signals of the detectors go to signal transforming amplifiers. Here take place the amplification, amplitude discrimination and forming of the signals and coupling them to the transmission line. In this way the signal processing unit gets a sequence of pulses with a stochastic distribution proportional to the neutron flux. The frequency of the pulse sequence can vary between 0.05 Hz and 50 KHz.

3.2 Structure and Operation of the Detection Blocks Used in the Intermediate Range

The detection block type is BDPNZ-16. The mechanical design of the block is identical with that of the source range block; it is different only in internal structure. A KNK-4 gamma background compensated ionization chamber is built into the block to detect the thermal neutrons. The chamber consists of two independent halves, hermetically sealed from one another. There is a gas dielectric condenser in each chamber half with one of their electrodes (the collector electrode) in common.

The half serving to detect thermal neutrons is filled with He3 and the compensating half is filled with He4.

When the detecting half is radiated with thermal neutrons the He3 isotope breaks down into tritium and nascent hydrogen, accompanied by strongly ionizing radiation. The ionizing radiation produced in this way is added to the background radiation and the gas charge of the chamber is ionized. This nuclear reaction does not take place in the compensating chamber half so only the background radiation produces ionization there. The opposed connection of the ionization current arising in both chamber halves gives a current which depends, with a good approximation, only on the neutron flux. Thus the output signal of the detection block is a direct current proportional to the neutron flux the magnitude of which extends from a few micro A to a few micro A [as published].

The output signals of the detectors go to frequency converters which send to the signal processing units a sequence of pulses with an even distribution at a frequency proportional to the input current or neutron flux, frequencies extending from 0.1 Hz to 100 KHz.

3.3 Structure and Operation of the Detection Blocks Used in the Energetics Range

The detection block type is BDPNZ-15. The housing of the block is made from stainless steel pipe; there is no insulating covering on the outer surface. At one end is a fitting to suspend it; at the other end is the outlet for three

inflexible "cables" made of stainless steel pipe, with inorganic insulation and triaxial shielding, which transmit the signals and supply power to the chamber. At the other end of the cables are hermetic sealing fittings and coaxial connectors. In the housing of the block is a KNK-3 type gamma background compensated ionization chamber.

The structure of the chamber completely coincides in principle with that of the intermediate range chamber but the gas with which they are charged is different. In the KNK-3 chamber both halves are filled with 95 percent He and 5 percent N_2 gas. The electrodes in the detecting chamber half are covered with B10 composition. When the chamber is radiated with thermal neutrons the B10 isotopes break down into He4 and Li7 isotopes, accompanied by strongly ionizing radiation which, together with the background radiation, ionizes the gas charge of the chamber. Background compensation takes place in the same way as described for the intermediate range chamber. The output signal of the chamber goes to a frequency converter which sends to the signal processing units a pulse sequence with an even distribution at a frequency, 660 Hz to 22 Hz, proportional to the neutron flux.

4. The Positioning of the Neutron Detectors and Equipment to Move the Detectors

Out of reactor design and life expectancy considerations the neutron detectors are located in vertical channels formed in the concrete ring (radiation shielding) surrounding the reactor. There is room for a total of 24 detectors in the concrete ring, as shown by Figure 1. The distribution of detectors is as follows:

- 18 for the operational measurement system (six in the source range, six in the intermediate range and six in the energetics range),
- 2 for reserve (in the energetics range),
- 3 for the reserve control room measurement system (in the source range), and
- 1 for reactivity measurement (in the intermediate range).

The detectors can be raised and lowered in the vertical channels from the height of the active zone. In the interest of sparing them (for life expectancy reasons) the source and intermediate range detectors must be drawn back after their measurement range is exceeded, so they have electric drives. The energetics detectors must be drawn out of the channels only in the course of replacing them so they are fixed detectors, or can be moved only manually. The detectors are drawn upward with the aid of a counterweight by a wire cable attached to their ends; for downward movement the detector cable is also the drawing cable. An electric drive winds the detector cable around a cable drum.

The drive mechanisms are located under an aluminum casting drive cover attached to the mouth of the channels containing the detectors, in the same airspace as the channels. The detector channels are filled with a neutral gas (nitrogen)--see Figure 2. The height position of the detectors is indicated in the block and reserve control rooms by a Selsyn transmitting-receiving device. Movement control of the chambers can take place automatically or by the operator. There are always detectors for the current measurement ranges and those above at the height of the active zone, that is in the measurement

position. Manual movement can be one at a time or in a group mode. In the case of group control the flux sensors of each subsystem in the same range can be moved together. Automatic control can move the detectors only as groups. As the result of a signal from the reactor protection system which performs a fast shutdown of the reactor (this is accompanied by a complete stop of the chain reaction) all moveable detectors of the NER automatically rise to the height of the active zone.

5. Structure and Operation of the Signal Processing Units

The signal transforming amplifiers and current frequency converters are located in the vicinity of the detectors, directly next to the measurement channels in the wall of the so-called biological shielding surrounding the reactor. Thus the small energy signals of the detectors must be transmitted a relatively short distance. For this reason the interference protection of the system is quite good. The 12 V amplitude, 2-4 micro-S wide pulses emitted by the signal transforming amplifiers and I/f converters at an impedance of 75 Ohm travel on a triaxially shielded cable about 100-150 m long through the power plant cable corridors to the signal processing units.

The signal processors convert the incoming frequency to a voltage and send the signal to amplifiers with logarithmic characteristics. So at the outputs of the logarithmators we get a voltage proportional to the logarithm of the neutron output. Since the span of the measurement in the source and intermediate ranges is large (six orders of magnitude) we use the signal after the logarithmators to measure neutron output, so these ranges have logarithmic scales. In the energetics range, in the interest of achieving the necessary precision, the measurement span is only two orders of magnitude so in this case we use the signals of the f/U converters to measure output. The signals of the logarithmators go to a differentiating amplifier in every measurement range. One can easily see that in the case of an exponentially changing input signal (neutron flux) reaching the input of the measurement system we will get at the outputs of the differentiators a voltage proportional to the reciprocal of the exponential time constant characterizing the speed of alteration.

So the measurement of the time constant (periodic time) of neutron output change is done on the basis of this voltage.

Signals falling between the 0.5 to 5 V voltage limits proportional to the neutron output and the time constant go through isolating units to the display units on the operator's console and to units monitoring limit values and generating safety signals. The latter generate, from signals coming from every detector, the following limit values and safety signals:

- Beginning of measurement range,
- End of measurement range,
- P (output) limit value,
- P 95 percent limit value (energetics range only),
- P 92 percent limit value (energetics range only),
- T (period time) 10 s,
- T 20 s (energetics range only), and
- T 40 s.

The generation of discrete safety signals is done with so-called taut logic; that is, when going over any limit value the relay providing the safety signal releases. The above mentioned relay contacts are connected to the appropriate inputs of the RTK and SZBVR. In any range the measurement can be done with suitable precision in intervals falling between the "beginning of range" and "end of range" levels.

The system uses these signals for automatic range selection.

6. Structure of the NER [Neutron Monitoring System]

The NER contains two redundant systems completely independent of one another. Both systems function in normal operation, but in the event of adjustment or checking for failure it is possible to disable the effect of one of the systems on the reactor.

Each system consists of three measurement channels and each channel consists of one each source, intermediate and energetics range detector and signal processor blocks.

The selection of measurement range is automatic. All three channels of one system always operate in the same measurement range. The measurement limits of the several ranges overlap one another by one order of magnitude.

Each system has an average generating unit which, in addition to averaging the signals of the three measurement channels, monitors deviation from the average of the values measured by the individual channels. If the deviation is greater than 20 percent the average generating unit excludes the deviant channel from the measurement and indicates a failure for the given channel. The "faulty channel" signal, which could arise from a power failure or pulling out a card, also activates the "exceeded limit value according to output" safety signal.

Limit values according to period time are fixed; the limit value according to output can be set by the operator from the operator's console. If the measured output approaches the set limit value by less than 10 percent or if it departs from this by more than 20 percent the NER warns the operator by lighting a lamp on the operator's console to reset the limit value by the appropriate amount.

7. Systems Technology Connections of the NER

The NER is an organic part of the control and safety system of the reactor. So in addition to its information display, limit value generating and warning functions it also participates in operating the control, limiting and safety systems.

The following analog outputs of the NER are used in other equipment:

--The signals, from all six operational detectors, in the energetics range (0 to 5 V) proportional to the level of the neutron flux are used by the RTK and the BISZ;

--The signals, from all detectors, proportional (0 to 5 V) to the neutron flux and the reciprocal of the period time are used by the reactor's computerized monitoring system.

The following discrete signals of the NER are used in other systems:

--Signals indicating that the limit values, according to output and period time, have been exceeded are processed by the SZBVR in all three ranges, distributed to the two identical systems with two out of three majority logic;

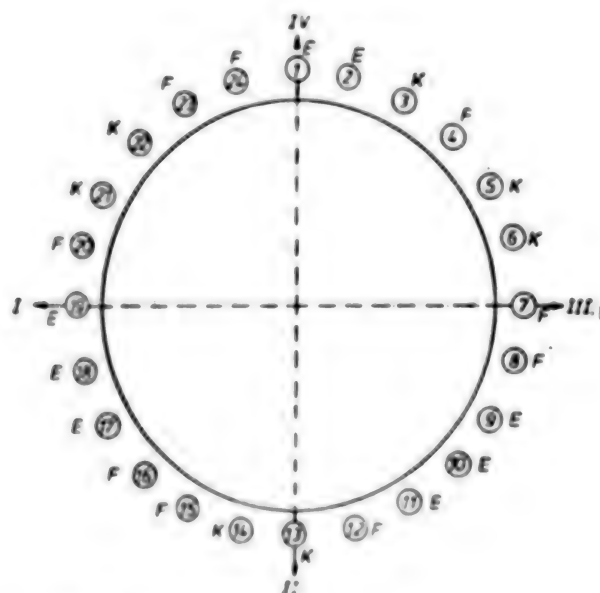
--The discrete signals of the operating measurement range switch protection to the appropriate range.

Figure 3 shows the system for supplying electric power to the NER. The three measurement channels of each system are connected to three different branches of the so-called uninterrupted safety power system of the power plant.

The measurement, monitoring and safety system described above, and developed with appropriate redundancy, is capable of stable long-term operation; to a large degree it is protected from device failures and disturbances in electric power supply; so highly reliable flux monitoring of the reactor is ensured.

FIGURE CAPTIONS

1. p 83. Location of detectors in the concrete ring surrounding the reactor.



Jeimagyarázat

F = forrás tartomány

K = közbeeső tartomány

E = energetikai tartomány

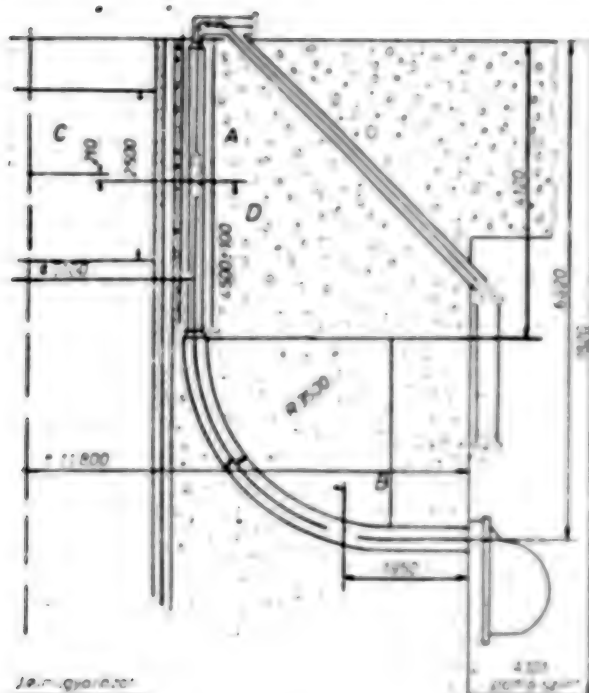
24(120)

F=source range

K=intermediate range

E=energetics range

2. p 84. A detector channel with drive mechanism.



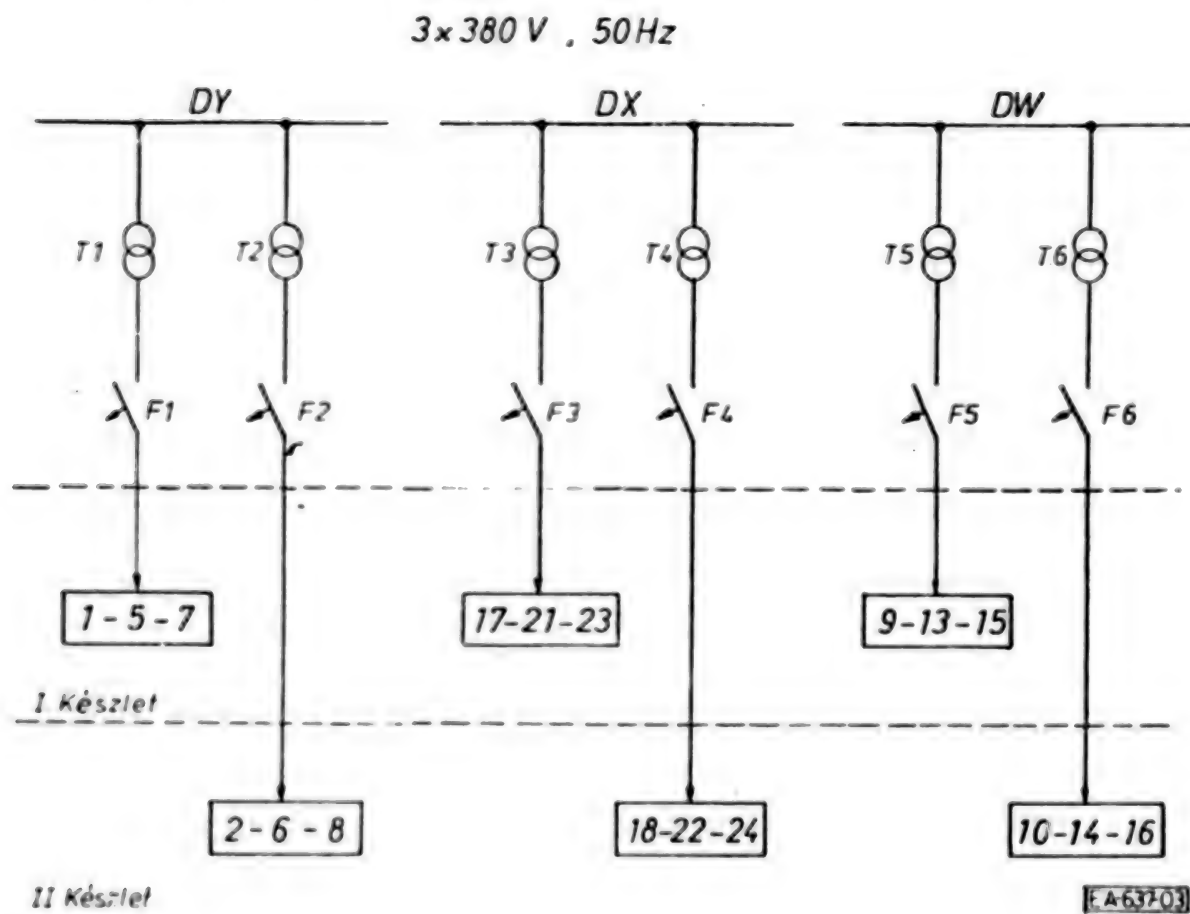
- A = üzemi helyzet
 B = kihúzott helyzet
 C = akt. zóna közepe
 D = detektor középpontja

A detektorok mozgási sebessége 50 mm/s

- A=operating position
 B=withdrawn position
 C=center of active zone
 D=middle of detector

The movement speed of the detectors is 50 mm per second.

3. p 85. Diagram of electric power supply for the NER.



I. Készlet=first reserve
II. Készlet=second reserve

8984
CSO: 5100/3012

NUKLIN DIRECTOR DISCUSSES COUNTRY'S NUCLEAR PROGRAM

Belgrade BORBA in Serbo-Croatian 15 Apr 87 p 7

[Article by Roksanda Nincic based on interview with Predrag Anastasijevic, general director of "Nuklin"]

[Text] Our country's attitude toward nuclear energy has been clear, and our delegation has recently reported in the United Nations Conference on Advancement of International Cooperation in the Peaceful Use of Nuclear Energy. The main commitments have been reiterated for BORBA by Predrag Anastasijevic, general director of "Nuklin," the community of Yugoslav nuclear institutes.

"We are above all in favor of a ban on the manufacturing of nuclear weapons. However, the countries which possess them are constantly improving them even though they have signed the 1968 Treaty on Nonproliferation of Nuclear Weapons. We also call for these weapons not to be used against those who have renounced them, nor that their use be threatened. We are also striving for international programs and cooperation which would facilitate the most effective possible control over nuclear installations, and we also took the initiative for conclusion of an international agreement to prevent armed attacks on peaceful nuclear installations.

"As for atomic weapons, it must also be said that the only peaceful method of destroying them is in the second generation of nuclear power plants--those which use the same fuel that is to be found in the weapons. This means that we need what are called fast reactors (in which the neutrons are not slowed down) if we want to destroy the weapons, but, of course, goodwill on the part of the great powers to take that route is a first condition." Anastasijevic actually wonders whether the right moment has been chosen to hold a political meeting on the use of nuclear energy. That is, the great powers are negotiating about arms reductions, but they have not even begun to do this. At the moment they are united only in agreeing that they will not make concessions to countries which do not possess nuclear technology, in the hope that in this way they will maintain their monopoly position as long as possible. The conflict of interests is more than obvious.

The First Is Prevlaka

And here we come to a question which in our country has been wrapped not in seven but in numerous and countless veils of secrecy. What is being done at the moment in Yugoslavia to build the odious nuclear power plants against which there were such loud rallies held last year?

"Of course, there was an uproar when no one wanted to say that the power plant at Chernobyl was above all a military facility whose principal job was manufacturing plutonium, while electric power was secondary. This was not said because this did not work to the advantage of the antinuke people, who had been making such a fuss. But the issue was one of domestic nuclear plants," Anastasijevic said, getting back to the main story. "Four power plants are planned in the country up to the year 2005. The first in order, as is well known, is the plant near Prevlaka in Croatia, for which the main designs are now being prepared, and an international competition is under way in which some 10 manufacturers are entered. That would be completed by the end of the year. How will it be paid for? By countertrade with deliveries of domestic equipment of similar quality. All the foreign firms which have applied have entered the competition in collaboration with our manufacturers, which will offer Yugoslav machinebuilding an extremely important chance of no longer selling its equipment at \$5 or \$6, but rather at \$200 per kilogram. Commencement of construction is planned by 1990, and it will have the capacity of Djerdap--1.00 megawatt.

"In any case the construction of energy facilities and indeed nuclear facilities in the country will depend above all on the results of the debate of the long-range plan for development of the fuel and power industry up to the year 2000, which is now taking place. The basic disagreements," Anastasijevic said, "have arisen in assessment of the production and consumption of electric power to the end of the century. It truly would be interesting to know whether conflicts of this kind break out anywhere else in the world. That is, the Federal Committee for Energy feels that production will be 135 terawatt-hours a year, while the electric power industry is insisting on 155 terawatt-hours (current output is 85). The dispute between these two camps is actually fundamentally nature. The federal committee feels that we will be developing slowly, that we will be in the crisis for a long time yet. It also assumes that over the next 15 years we will be restructuring the economy, as has indeed been promised from the highest places, that is, that we will be freeing ourselves of industries which consume a great deal of electric power. Both of these facts would signify, at least according to the members of the committee, a slower growth of the demand for electric power."

The electric power industry is in turn brandishing quite different arguments. First, as confirmed by Anastasijevic, the economic crisis is not always in proportion to the consumption of electric power. We are developing unevenly, we do not live by standards, we consume electric power inefficiently, we are not investing in industrial development, but in automobiles and weekend cottages (or that at least was the case until recently). So, the electric power industry, probably on the basis of prior experience, concludes that the growth of consumption of electric power will be faster than the growth of the social product, especially since no one is renouncing electric power in choosing sources of energy. If the electric power industry is right--and it

must be said that its logic is rather convincing--then we will soon be in need of more power plants of all kinds. In any case, the plan is to be adopted by the end of this year. If we live long enough, we will see, or, as the enemies of domestic nuclear power plants would say, Chernobyl has happened, and now we will see the results.

In the meantime the specialists responsible for this are working behind well-closed doors on technical-and-economic analyses to ascertain which power plants are the most economical and inexpensive, to arrive at estimates of production costs and operating costs, and to think up ways of furnishing the funds.

The Government and Its Position

But let us dwell for a moment on the nuclear fuel cycle, that is, on the possibilities for domestic intelligence and machinebuilding to master nuclear technologies, raw materials, fuel elements, methods of enrichment, processing and storage, since this, as we have said, is a condition for the country to have at least relative energy independence.

First of all, Yugoslavia possesses about 60,000 tons of prospected reserves of uranium ore. Should we master the cycle referred to, the technical energy potential would be tenfold greater than the coal reserves that exist in the country. At present we are importing uranium, since on the world market it is cheaper and of higher quality (our ore contains about 800 grams of uranium per ton, while the Canadian ore, for example, contains 8 kg. We are having the Americans enrich the uranium.

The basic precondition for us to begin to do all this is first of all personnel, and we do have them in the country's nuclear institutes. Meanwhile we would have to form enterprises for production of the raw materials, supplies, and fuel, and a market that would be supplied from the construction of the power plants and outside the country from exports. Some 10 projects have been done to further those purposes, some things are now going on, Anastasijevic said, and some things we will not even do because it turned out that they were not economical. There have been plans for the Yugoslav economy to set aside \$20 million for these undertakings--in dinars, of course--and this would be over the period from 1986 to 1990. The money is already coming in for certain projects.

As for our famous republic borders and their influence on Yugoslav nuclear projects, Anastasijevic said that the republics are responsible for construction of electric power facilities. Up to now four republics (Slovenia, Croatia, Serbia, and Bosnia-Herzegovina), which have their institutions in "Nuklin," have been interested in nuclear power plants, and the Macedonians and people from Vojvodina are also interested, but they do not have institutions for that purpose. Kosovo is relying on lignite, but Montenegro is thinking about nuclear energy. The republic electric power industries are responsible for supplying their own areas, but it is possible for several of them to build a single project. The Slovenes and Croats built Krsko, and now they are also doing Prevlaka together. There will probably be cooperation of that kind for all the nuclear power plants, and the specific

sites for the hydroplants to come will be chosen by the republics which have applied to build them. Certainly there will not be any more of them on the Sava, which the public has greatly rebelled against, since the water would be heated above 31 degrees, which would kill the fish. That makes the Danube much more suitable, and incidentally there are already a great number of nuclear power plants on it, Anastasijevic feels.

The last question was whether the public is expected to become very upset about electric power plants once again and what about the stories that we are accepting foreign nuclear waste on our soil?

"Yes, good money is being earned storing the waste of others. The Chinese, for instance, are getting \$1,500 per kilogram. But we do not have the resources to solve the problems of others when we have not paid enough attention even to our own. As for the reaction of the public, that will depend above all on the position taken by the highest bodies in the country. The government's Presidency, the FEC, and the Socialist Alliance must take a clear and public position on domestic nuclear power plants. If they waver, what can others be expected to do?" the subject of our interview concluded.

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CSO: 5100/3015

ALFONSIN VOWS TO SUPPORT NUCLEAR DEVELOPMENT

PY220054 Buenos Aires NOTICIAS ARGENTINAS in Spanish 2150 GMT 21 May 87

[Text] Buenos Aires, 21 May (NA) — President Raul Alfonsin today publicly vowed to continue with the development of the Argentine nuclear program, despite the serious budget problems in the sector. Alfonsin made this remark when swearing in Emma Victoria Perez Ferreira, the new president of the National Atomic Energy Commission (CNEA) this afternoon during a ceremony that began at 1700 in the White Room at Government House.

During the ceremony, Alfonsin also swore in Eduardo Mascardi as the new Merchant Marine Secretary. Mascardi will replace outgoing secretary Pedro Jose Casado Bianco.

Casado Bianco, whom Alfonsin thanked for "his patriotic work" since the creation of the secretariat, attended the ceremony. However, Constantini, whose work as CNEA president was praised by Alfonsin, did not attend.

Present at the ceremony were Interior Minister Antonio Troccoli, Economy Minister Juan Sourrouille, Defense Minister Horacio Jaunarena, Public Works Minister Pedro Trucco, Foreign Minister Dante Caputo, and Secretary General Carlos Becerra. Also in attendance were most of the members of the Council for the Consolidation of Democracy, of which the new CNEA president is a member; CNEA technicians and employees; relatives of the newly appointed officials; and some 100 special guests.

As he usually does, Alfonsin thanked both Casado Bianco and Constantini for their work in the Merchant Marine Secretariat and the CNEA, respectively. In the case of Constantini, after emphasizing the work done by the CNEA, Alfonsin said that Constantini "did an extraordinary job" as head of the organization. He recalled that when he visited some CNEA plants "it seemed to me that I was entering the future as I saw how the country, despite so many problems, had managed to maintain a sector in which we can continue to develop advanced technology."

He said that this was made possible especially "by the efforts of those who felt the CNEA is a way to achieve development, not only through a prestigious activity but also through work that will show the world we are capable of developing technology and using important activities of general and industrial use in our own country."

"We will continue on this course, with great difficulty, but we will give as much support as we can," he said.

He added that he wanted to "publicly express the commitment I have assumed with the new CNEA president to support her, and to see what we can do, even in this difficult situation, to satisfy so many workers, technicians, and scientists, who are bringing honor to Argentina."

Mrs Perez Ferreira, in brief remarks after the ceremony, admitted that the situation at the CNEA "is a bit bothersome" but she said that "to the extent possible the labor conflicts involving CNEA workers will be solved."

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CSO: 5100/2099

PEACE COUNCIL ON UK POSITION ON NUCLEAR WEAPONS

PY242227 Buenos Aires NOTICIAS ARGENTINAS in Spanish 1236 GMT 24 Apr 87

[Text] Buenos Aires, 25 Apr (NA)--The Argentine Peace Council [Consejo Argentino de la Paz] has reiterated its charges that there are nuclear weapons on the Malvinas Islands thus rejecting the British denial made at the UN General Assembly.

The council's accusation refers to the speech delivered by British Ambassador John Thomson. It points out that "for the first time since the 1982 Malvinas war, a British official has made a reference to our campaign."

In a communique the council says the British statement contradicts itself because it says that "for security reasons it has long been a practice of the countries that have nuclear weapons not to confirm or deny the presence of nuclear armaments at a determined point and at a specific time."

In this regard the council states its "profound disagreement" with the statement made by the British.

The council reiterates that silos, launching pads and storage facilities for nuclear missiles have been built on the islands, that there are at least 16 launching pads for medium- and long-range missiles and that each launching pad has a battery with six automatic triggers [disparadores automaticos].

The council adds that "the construction of the Mount Pleasant Airport provides a quick source for new nuclear weapons which can easily be transported by airplanes." It notes that "nuclear weapons can also arrive on ships."

Ambassador Thomson said in his speech at the UN General Assembly that "as has been clearly stated several times, the United Kingdom has fulfilled and will continue to fulfill its obligations in accordance with the additional protocols of the Tlatelolco Treaty (for the denuclearization of Latin America)."

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CSO: 5100/2097

COMMENTATOR VIEWS CRISIS WITHIN NUCLEAR SECTOR

PY090112 Buenos Aires NOTICIAS ARGENTINAS in Spanish 1830 GMT 8 May 87

[By Daniel Santoro]

[Text] Buenos Aires, 8 May (NA) -- The serious crisis that the National Atomic Energy Commission (CNEA) is experiencing calls for rapid action by the government to preserve one of the few sophisticated technological skills that Argentina has mastered.

It is surprising that an important organization like the CNEA has been practically without a leader this month, since CNEA President Alberto Constantini has not reported to work and has submitted his irrevocable resignation because of major budget problems. In the meantime, the main CNEA construction projects -- the completion of the Atucha II and the Arroyito heavy water plant in Neuquen -- are paralyzed. On 4 May, all CNEA personnel began a 15-day stoppage demanding a salary increase.

The government should be taking a stand and outlining its position on the Argentine nuclear program, instead of advocating a Latin American technological plan through the Foreign Ministry while asphyxiating the CNEA through the Finance Ministry.

It is surprising that Congress has not even asked for information on the subject, and that the public should learn about the issue through leaks about the struggle over the CNEA budget between Constantini and Finance Secretary Mario Brodersohn, who seems to believe the CNEA is no more important than the railway company.

Is it good for our country to train technicians and scientists who will go abroad or, if we are lucky, will be hired by the local private sector? This is what is happening at the Argentine Nuclear Enterprise for Electric Power Plants [ENACE]. Where 75 percent of the personnel belong to the CNEA and the remaining 25 percent to Kraftwerk Union (KWU), which is in charge of the engineering design and construction of Atucha II, among other projects. In recent months, 79 professionals and 93 technicians, out of a total of 630 ENACE employees, resigned.

Beyond the old controversy of whether it is more convenient to generate power with hydroelectric or with nuclear plants, Argentina will certainly need more energy in the future. The fate of this sector cannot be decided by one government, much less by one sector of the government.

The CNEA crisis has also affected, among other projects, the fourth nuclear plant project, the completion of the Tandem electrostatic heavy ion accelerator of the

Constituyentes plant, the Arroyito heavy water plant in Neuquen, and the Pilcaneyu uranium enrichment plant.

The resolution of the CNEA problem will decide not only the fate of the 5,600 CNEA employees but also the future of the entire nuclear private sector and the country's technological future. The executive branch and Congress should study Constantini's CNEA restructuring project, to make sure the CNEA will become a self-supporting agency, so the Argentine nuclear program does not fall under sectorial or foreign interests.

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CSO: 5100/2097

BRIEFS

GOVERNMENT APPOINTS CNEA PRESIDENT--Buenos Aires, 14 May (TELAM)--The executive branch has announced through Decree 719 the appointment of Victoria Perez Ferreira as the new president of the National Commission for Atomic Energy, replacing Alberto Rafael Constantini. Through Decree 718, the government accepted the resignation submitted by Constantini. [Text] [Buenos Aires TELAM in Spanish 1627 GMT 14 May 87 PY] /9274

FOOD IRRADIATION PLANT--Cordoba, 6 May (AFP)--It was officially announced here in Cordoba, 710 kilometers north of Buenos Aires, that Argentina will build an industrial size food irradiation plant worth approximately \$4.0 million in Peru. The plant, which will be built in Lima, will have a capacity of half million curies in cobalt-60, and will be able to treat a large variety of products. This project will be handled under a line of credit which the two countries have for the development of specific projects. It will be under the auspices of the National Atomic Energy Commission (CNEA) and the CORATEC Company of Cordoba. CORATEC representatives traveled to Lima today to sign the papers to set the project in motion. [Text] [Paris AFP in Spanish 1556 GMT 6 May 87 PY] /9274

ARCAL NUCLEAR MEETING--Santiago, 10 May (EFE)--The fourth meeting for technical coordination and planning of the cooperation arrangements for the Promotion of Nuclear Science and Technology in Latin America Program (ARCAL) will be held in Chile between 11 and 15 May. The meeting is sponsored by the IAEA and coordinators from 12 of the area's countries will participate. The ARCAL program began in 1981 at the insistence of the Andean subregion countries (Bolivia, Colombia, Ecuador, Peru, and Venezuela) with the IAEA as adviser. [Text] [Madrid EFE in Spanish 0018 GMT 11 May 87 PY] /9274

CSO: 5100/2097

TEXT OF NUCLEBRAS ANNUAL REPORT FOR 1986

Brasilia CORREIO BRAZILIENSE in Portuguese 8 Apr 87 pp 10, 11

[Text] Dear Shareholders:

We are pleased to submit to you the operational report and the financial statements summarizing NUCLEBRAS' corporate activities for 1986.

We should point out that the final report by the Nuclear Program Evaluation Commission has been finished and submitted. Its basic directives were written by the Honorable President of the Republic upon his approval on 1 August of a joint presentation of reasons to continue by the National Safety Council and the Ministry of Mines and Energy, which supports the commission's conclusions and recommendations. Following this approval, the Federal Government set goals and objectives to be met by the Nuclebras Group under the Nuclear Program. Basically, this government decision confirmed the schedule of operations and priorities already set by the current administration, implementation of which depends on a financial framework that it was not possible to put in place in 1986, in spite of efforts undertaken by the inter-ministerial working group that was appointed for this very purpose.

The Nuclebras Group's uncertain economic and financial situation is basically due to the failure to arrange a financial framework planned by earlier administrations in which 40 percent of the financing would be provided by the National Treasury and 60 percent would be arranged in loans: i.e., 40 percent would be obtained from Brazilian credits and loans and 20 percent from foreign financing and loans. These limitations on financing, especially in view of the country's economic difficulties, has led to repeated delays over the last 4 years and rescheduling of operations with consequent cost increases and greater outlays for financing. Given the nuclear program's goals and objectives, efforts were redoubled toward the end of the fiscal year to draw up a Long-Term Recovery Program for the Nuclebras Group that would make it possible to arrive at a firm financial arrangement to support operations from 1988 on, obtain participation by the electrical power industry, and acquire capital from the National Treasury and foreign credits and loans as well as a plan for strengthening financing. The time required to prepare and have approved such a long-term plan, however, requires significant participation by the National Treasury in 1987 as the only way to avoid further delays in implementing operations and prevent an adverse impact on costs and quality.

Negotiations with the foreign partners have been concluded, and the German directors serving on the boards of NUCLEN and NUCLEP have been replaced under a technology-transfer arrangement that retains the technical assistance and guarantees provided by these partners in the various operations related to power-plant engineering and the manufacture of heavy components.

Operations carried out in 1986 were limited because of financial difficulties. This has led to further delays in implementation and operational difficulties.

Among the various operations, it should be pointed out that concentrated uranium production fell to only 36 metric tons vs. 100 metric tons in 1985. Reactor units were delivered to FURNAS to recharge the Angra I plant. These were the first units produced by the reactor unit plant. The heavy-component plant finished manufacturing the accumulators for the Angra II plant and replaced the tubes on the Angra I condenser under a contract with FURNAS.

The production and refining of concentrated heavy minerals from monazite sands was affected by the reduction of capital needed to meet the demands of the growing consumer market and to some extent by the raw material shortage and the price freeze.

Operations now in progress have proceeded slowly, experiencing a 10-month delay in the work schedule of priority operations for Angra II and the first stages of the enrichment process.

In the area of technological development, the gift of a laboratory from the Karlsruhe Nuclear Center for undertaking new development studies of the centrifugal enrichment process and the agreement signed with the Jülich Nuclear Center with the participation of German firms and the International Atomic Energy Agency in the area of PWR reactor safety technology to complement international advances in this field should be mentioned.

In the area of nuclear power plant engineering, negotiations were begun with Empresa Nuclear Argentina de Centrales Eléctricas (ENACE) for the purposes of setting up a service and exchange program. The contract should be signed early next year.

The financial statements show higher losses for the fiscal year as well as net losses in working capital. The main causes are the same as last year's, since the steps necessary to improve the situation have not been taken. The figures shown for long-term areas reflect favorable assets which may be realized by the delivery of the materials and services needed to build the nuclear power plants.

At year's end, selective wage adjustments were made in an attempt to prevent the loss of specialized technical personnel, but difficulties in carrying out the group's operations continue to affect morale.

We should mention the make-up of Nuclebras' board of directors, which has the following members: the Chairman and two directors from Nuclebras, Engin-

eer Mario Penna Bhering, president of Eletrobras, and Messrs Antoninho Marmo Trevisan, Andrea Calabi, Oscar Salla, Albano Franco and Antônio Oliveira Santos.

Directors Ronaldo Arthur Fabrício and Hércules Eduardo Dutra resigned during the year, and Messrs Fernando Antônio Salgado Henning and Rodolpho Paulo Gonçalves were appointed to replace them.

We take this opportunity to express our sincere gratitude to the Honorable President of the Republic, José Sarney, and to the Honorable Minister of Mines and Energy, Antônio Aureliano Chaves de Mendonça, and other government officials for their confidence in us and the support we have received from them.

Board of Directors

BALANCE SHEET (in thousands of cruzados)

	ASSETS	
	As of 12/31/86	As of 2/28/86
WORKING CAPITAL		
Cash on Hand and in Bank Accounts	84,145	8,713
Repayment of Loans	237,446	187,120
Accounts Receivable	33,308	11,274
Deposits Committed to BACEN	31,395	28,006
Advances to Vendors	66,421	27,204
Other	23,851	18,715
Inventory	222,222	173,825
Expenses for Following Fiscal Year	<u>11,707</u>	<u>56,955</u>
	<u>710,495</u>	<u>511,812</u>
LONG-TERM ASSETS		
Advances on Future Capital Improvement	7,247	7,879
Services to be Invoiced	8,504,331	4,832,779
Recoverable Service and Equipment Costs	24,624	76,571
Loans and Credits	41,920,791	29,208,677
Other	<u>185,580</u>	<u>173,403</u>
	<u>50,642,573</u>	<u>34,299,309</u>
PERMANENT ASSETS		
Investments	1,151,749	1,220,562
Immovable Property	2,032,333	1,755,948
Diferred Items	<u>3,485,173</u>	<u>3,265,195</u>
	<u>6,669,255</u>	<u>6,241,705</u>
	<u>58,022,323</u>	<u>41,052,826</u>

LIABILITIES

WORKING CAPITAL	As of 12/31/86	As of 2/28/86
Vendors (Subsidiaries: Cz\$190,590 as of 12/31 and Cz\$218,585 as of 2/28)	647,426	911,886
Loans and Credits	18,736,124	5,090,390
Salaries and Social Benefits	879,664	573,634
Other	<u>181,357</u>	<u>182,297</u>
	<u>20,444,571</u>	<u>6,758,207</u>
 LONG-TERM LIABILITIES		
Vendors	818,079	655,156
Loans and Credits	35,789,913	36,315,235
Federal Credits for Future Capital Improvement	2,111,406	685,004
Other	<u>21,115</u>	<u>21,115</u>
	<u>38,740,513</u>	<u>37,676,520</u>
 FUTURE FISCAL YEARS		
Receipts from Future Fiscal Years	<u>288,373</u>	<u>150,930</u>
	<u>288,373</u>	<u>150,930</u>
 NET ASSETS		
Authorized Capital	4,137,287	2,052,023
Less Unpaid Capital	<u>18,122</u>	<u>8,988</u>
Fully Paid Capital	4,119,165	2,043,035
Currency Correction on Capital	<u>2,851,025</u>	<u>3,761,081</u>
Capital Paid to Date	6,970,190	5,804,116
Capital Reserves	7,031,219	1,691,344
Accumulated Losses	(10,452,543)	(5,667,342)
Losses from Period Ended 2/28/86	-	(5,653,763)
Economic Stabilization Program	<u>-</u>	<u>292,824</u>
Adjustments (Decree 2.284/86)	<u>(1,451,134)</u>	<u>(3,532,821)</u>
	<u>58,022,323</u>	<u>41,052,826</u>

The explanatory notes are an integral part of these financial statements.

BOARD OF DIRECTORS

Licínio Marcelo Seabra, Chairman, CPF: 001.170.136-68
 José Pinto de Araújo Rabello, Executive Director, CPF: 290.227.387-87
 Jarbas Alberto di Piero Novaes, Director, CPF: 004.212.517-00
 Paulo Lima, Director, CPF: 010.024.497-15
 Rodolfo Paulo Gonçalves, Director, CPF: 006.948.357-49
 David Neiva Simon, Director, CPF: 007.834.717-34
 Fernando Antonio Salgado Henning, Director, CPF: 095.259.987-20

ACCOUNTING DEPARTMENT

Alex Borges Barreto, Accountant, CRC-RJ-46.679-9-S-DP-533, CPF: 363.500.367-00

STATEMENT OF RESULTS FOR THE FISCAL YEAR ENDED DECEMBER 31, 1986

	March 1, 1986 to December 12, 1986 (thousands of cruzaos)	Reclassified January 1, 1986 to February 2, 1986 (millions of cruzeiros)
Gross Receipts from the Sale of Pro- ducts and Services	594,879	1,649
Less Returns, Rebates, Sales and Service Taxes	<u>105,043</u>	<u>58</u>
Net Receipts from the Sale of Products and Services	489,836	1,591
Cost of Products and Services Sold	<u>34,215</u>	<u>1,486</u>
Gross Operating Profits	<u>455,621</u>	<u>105</u>
Administrative Operating Expenses (Receipts)	517,628	88,180
Financing Costs	(5,382,770)	1,695,748
Prospecting and Research	147,387	14,543
Amortization of Deferred Assets	575,446	93,611
Administrators' Fees	<u>2,123</u>	<u>230</u>
	<u>(4,140,186)</u>	<u>1,892,312</u>
	4,595,807	1,892,207
Net Loss from Interest in Subsidiaries	<u>(317,596)</u>	<u>(74,042)</u>
Net Operating Profits (Losses)	4,278,211	(1,966,616)
Net Non-Operating Receipts (Expenses)	<u>25,981</u>	<u>(367)</u>
Currency Correction of Balances		
Net Assets	(367,289)	(411,959)
Fixed Assets	<u>1,181,335</u>	<u>1,384,521</u>
Currency Adjustments on Fixed Asset Financing	814,046	972,562
Net Profits (Losses) for the Period	<u><u>1,714,334</u></u>	<u><u>5,653,763</u></u>

**BREAKDOWN OF NET LOSSES FOR THE FISCAL YEAR COMMENCING
January 1, 1986, and Ending December 31, 1986
(Thousands of Cruzados)**

Profits (Losses) for the Period	(5,653,763)
Two Months Ended February 28, 1986	<u>1,714,334</u>
Ten Months Ended December 31, 1986	<u>(3,939,429)</u>
Adjustment per Economic Stabilization Program (Decree 2.284/86)	<u>292,824</u>
Net Losses for the Fiscal Year	<u><u>(3,646,605)</u></u>
Net Loss per 1,000 shares in cruzados	<u><u>49.97</u></u>

The explanatory notes are an integral part of those financial statements.

CHANGES IN NET WORTH

	CURRENTLY PAID CAPITAL	CAPITAL RESERVE	SPECIAL ACCOUNTS PER LEGAL DECREE 2284/86	
	Capital	Subsidies for Investment	Losses for Period Ended Feb. 2, 1986	Total
Millions of Cruzeiros				
Balances as of 12/31/85	2,042,744	1,200,322	-	1,297,167
Capital Improvement	291	-	-	291
Current Correction	-	381,202	-	411,959
Losses for the Period	-	-	(5,653,763)	(5,653,763)
Balances as of 2/28/86	<u>2,043,035</u>	<u>1,581,524</u>	<u>(5,653,763)</u>	<u>(3,944,366)</u>
Thousands of Cruzados				
Balances as of 2/28/86	2,043,035	1,581,524	(5,653,763)	(3,944,366)
in cruzados				
Cy Correction per CVM	-	109,820	-	118,701
Special Directive 050	-	-	-	-
Adjustments per Legal	-	-	-	-
Decree 2284/86	-	-	-	-
Balances as of 2/28/86	2,043,035	1,691,344	(5,653,763)	(3,532,821)
Capital Improvement	2,076,130	-	-	-
per AGO of 4/29/86	-	-	-	-
Funds Available for	-	64	-	64
Investment Allocation	-	-	-	-
Cy Correction per CVM	-	339,811	-	367,289
Directive 057	-	-	-	-
Transferred to Net Re-	-	-	5,653,763	5,360,939
suits for Fiscal Year	-	-	-	-
Fiscal Year Net Losses	-	-	-	-
Balances as of 12/31/86	<u>4,119,165</u>	<u>2,031,219</u>	<u>(3,646,605)</u>	<u>(3,646,605)</u>
	<u>2,851,025</u>	<u>(10,452,543)</u>	<u>-</u>	<u>(1,451,134)</u>

The explanatory notes are an integral part of these financial statements.

SOURCES AND ALLOCATION OF FUNDS

SOURCE	March 1, 1986 to December 12, 1986 (thousands of cruzados)	Reclassified January 1, 1986 to February 2, 1986 (millions of cruzeiros)
Shareholders		
Federal Credit for Future Capital Improvement	1,207,189	-
Capital Paid In		291
Third Parties		
Transfer of Immovable Property and Deferred Items to Assets		
Working Capital	37,496	12,766
Subsidies for Investment	64	-
Long-Term Credit	1,368,509	3,418,552
Goods and Services	58,388	-
Total	<u>2,671,646</u>	<u>3,431,609</u>
ALLOCATION		
Operations		
Net Losses (Profits) for the Fiscal Year	(1,714,334)	5,653,763
Less Charges Not Considered Disbursements		
Reduction of Fixed Assets	18,198	5,370
Depreciation and Amortization	637,887	98,401
Currency Adjustments on Long-Term Debts	5,935,282	10,301,628
Financial Charges on Long-Term Debts	22,056	202,109
Net Loss from Participation in Subsidiaries	317,596	74,042
Plus Receipts Not Considered Cash Income		
Charges on Loans Extended	8,744,733	5,477,719
Currency Adjustments for Subsidiary Operations	662,801	541,563
Credit from Currency Adjustments	814,046	972,562
Currency Adjustments on Advances for Future Capital Improvement	1,400	2,064
Other Financial Receipts	4,431,574	51,787
Fixed Assets	<u>6,009,201</u>	<u>2,017,908</u>
Acquisition of Capital Goods	53,727	4,509
Increase in Deferred Assets	31,518	9,648
Increase in Investment	<u>423</u>	<u>86</u>
Other Items		
Increased Recoverable Service and Equipment Costs	1,984,809	52,246

Increased Joint Operations with Subsidiaries	390,457	246,963
Conversion of Long-Term Obligations to Short-Term Obligations	7,687,205	127,149
Other	<u>1,987</u>	<u>191</u>
	10,064,458	426,549
Total Allocations	16,159,327	2,458,700

INCREASE (DECREASE) IN NET WORKING CAPITAL FOR THE FISCAL YEAR	<u>(13,487,681)</u>	<u>972,909</u>
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REDUCTION OF NET WORKING CAPITAL FOR THE FISCAL YEAR
COMMENCING JANUARY 1, 1986, AND ENDING DECEMBER 31, 1986,
in thousands of cruzados

As of February 28, 1986	972,909
March 1, 1986, to December 31, 1986	(13,487,681)
Effects of Adjustments under the Economic Stabilization Program on New Working Capital	<u>(14,415)</u>
	<u>12,529,187</u>

BREAKDOWN, in thousands of cruzados

	As of 12/31/86	As of 12/31/85	Difference
Current Assets	710,495	343,494	367,001
Current Liabilities	<u>20,444,571</u>	<u>7,548,383</u>	<u>12,896,188</u>
	(19,734,076)	(7,204,889)	(12,529,187)

The explanatory notes are an integral part of these financial statements.

EXPLANATORY NOTES TO FINANCIAL STATEMENTS
(thousands of cruzados)

NOTE 1. OPERATIONS

Empresas Nucleares Brasileiras (NUCLEBRAS) is a semi-private corporation chartered to implement the Federal monopoly in the nuclear energy sector. Its purposes are mineral prospecting, the production of uranium concentrate, the development and installation of a conversion unit, ore enrichment, the manufacture of a reactor unit, the development of a reprocessing unit, and the construction of nuclear power plants. It shall also provide all engineering services and the equipment and materials needed to build, assemble and operate said plants, including the financing of construction and the manufacture of the reactor unit.

The pace of the Company's operations has been held to a minimum, in part due to the process of re-evaluation of Nuclebras' participation in the Brazilian nuclear program as set forth in Position Paper No. 009/86 of August 1, 1986, and approved by the president of the Republic, and in part due to the shortage of funds available to carry out the program and reach the goals by the dates planned. The repeated delays that have been experienced have signi-

ificantly affected operating costs and are contributing to increased indebtedness, which has been aggravated by a lack of the necessary capital.

The negative net working capital condition is due to the fact that the amounts receivable from the financing of construction and the provision of fuel for Units 2 and 3 at the Admiral Alvaro Alberto Nuclear Power Plant, which are the principal assets, will be realizable upon delivery of the units ready to operate, which is scheduled for 1992 and 1995, respectively, i.e., a long-term arrangement, with maturity dates that are poorly coordinated with the largest liability, which consists of the loans and financing obtained from third parties, which were used to perform contracted services, and portions of these loans have short-term due dates. Aggravating the situation still further is the fact that these have almost all been renegotiated on short-term arrangements.

The Nuclear Industry Recovery Plan, now under way, should make it possible to formulate measures for improving financing and obtaining the long-term financing necessary to carry out the projects for which Nuclebras is responsible.

NOTE 2. MAIN ACCOUNTING PROCEDURES

- a. The financial statements have been drawn up and submitted in accordance with Public Law No. 6.404/76, taking into account the modifications effected under the Economic Stabilization Plan as explained under Note 3.
- b. The results have been verified in accordance with the requirements in effect for the fiscal year as follows:
 - Revenue earned during the fiscal year and costs, expenses and charges incurred during the fiscal year, regardless of receipts or payments, with the exception of items related to the provision of goods and services for construction of the nuclear power plants, which are accumulated under Long-Term Assets;
 - Net effects of currency correction on fixed assets and net worth and currency or exchange fluctuations, at official rates, on current and long-term assets and liabilities;
 - Charges for depreciation of immovable property and amortization of deferred items;
 - Earnings and losses from participation in subsidiaries.
- c. Assets and liabilities due within 360 days are considered current.
- d. Charges for unusual operations with subsidiaries are considered long-term assets.
- e. Investments (represented by treasury bills (OTNs)) are entered under the cost of acquisition plus earnings due as of the close of the fiscal year.
- f. Inventory was entered at the average cost of acquisition, which is less than the market price or net selling price. Imports in progress were entered as identified costs incurred as of the date of the balance.
- g. Investments made by the Company in subsidiaries were evaluated by the method of equivalent assets. Other investments were entered at the corrected cost.
- h. Fixed assets were entered at the corrected cost of construction or acquisition. Depreciation was figured by the linear method as follows: build-

ings, twenty-five (25) years; machines and equipment, ten (10) years; furniture and fixtures, ten (10) years; and vehicles, five (5) years.

- i. Deferred items are shown at cost plus currency correction and were amortized by the linear method over five (5) years up to 1987, with the exception of preliminary costs for the second operating phase of the Poços de Caldas Industrial Mining Complex, whose amortization commences in January of 1985 and extends over ten (10) years. Expenses incurred after 1984 will be amortized through 1994.

NOTE 3. EFFECTS OF THE CHANGE FROM CRUZEIRO TO CRUZADO AND THE LOSS OF PURCHASING POWER

In 1986 the effects of the loss of purchasing power suffered by Brazilian currency under the Economic Stabilization Plan, which converted the cruzeiro into the cruzado, were as follows:

a. Format of Financial Statements

Due to the Economic Stabilization Plan, which became law under legal Decree No. 2.284/86 and, among other things, converted the cruzeiro into the cruzado, special financial statements were drawn up as of February 28, 1986, in accordance with the procedures set forth in CVM Directives Nos. 48 and 50.

The financial statements as of December 31, 1986, were drawn up and submitted in accordance with the provisions set forth under CVM Guidelines No. 11 of September 15, 1986, CVM/DTE Circular Letter No. 309 of December 17, 1986, CVM Directive No. 59 of December 22, 1986, and CVM Guidelines No. 12 of January 12, 1987.

b. Currency Correction of Fixed Assets and Net Worth

The fixed asset and net worth accounts were adjusted in accordance with official indices and revised as follows:

The variation in the value of ORTNs [Brazilian Treasury bills] between December of 1985 (70,613.67 cruzeiros) and February of 1986 (93,039.40 cruzeiros) was entered directly against the fiscal year results under the account for Currency Correction of Fixed Assets and Net Worth.

The variation in the value of ORTNs between February 1986 and OTNs prorated to February 28, 1986 (99.50 cruzados) entered in the asset suspense account for Adjustments due to the Economic Stabilization Program per Legal Decree 2.284/86 was transferred to the results for the fiscal year per CVM Directive No. 50.

The variation in the value between OTNs prorated to February 28, 1986, and OTNs prorated to December 31, 1986 (119.49 cruzados) was entered directly against results for the fiscal year under the account for Currency Correction of Fixed Assets and Net Worth per CVM Directive No. 57.

c. Adjustment of Assets and Liabilities

Balances in the accounts for current and long-term assets and current and long-term liabilities, which were affected by Legal Decree 2.284/86, were deflated as of February 28, 1986, and the results of this deflation were entered in an asset suspense account (Adjustments per Legal Decree 2.284/86) and finally transferred to the results at the close of the fiscal year.

Assets and liabilities subject by contract or law to subsequent currency fluctuations based on OTNs, if maturing after February 28, 1987, were revised proportionally based on the value of OTNs prorated to December 31, 1986, and the adjustments were entered directly against fiscal year results per CVM Directive No. 57.

In order to grasp the effects of these adjustments better, a statement of the account for Adjustments Effected under Legal Decree 2.284/86 is given below:

Earnings from the Conversion of Accounts Payable with no Currency Adjustment Clause	
Vendors	<u>394</u>
Losses from the Conversion of Accounts Receivable with no Currency Adjustment Clause	
Customer Accounts Receivable	48
Other Accounts Receivable	<u>52</u>
	<u>100</u>
Gains from Revising Accounts Receivable with no Currency Adjustment Clause	
Income Tax	1,682
Other Fees and Charges	<u>1,060</u>
	<u>2,742</u>
Losses from Revising Accounts Payable with a Currency Adjustment Clause	
Financing	22,716
Other Obligations	<u>44,478</u>
	<u>67,194</u>
Receipts from Adjusting Provisions	
Bad Debts	<u>1</u>
Special Currency Correction	
Fixed Assets	405,564
Net Worth	<u>(118,701)</u>
	<u>286,863</u>
Results of Equivalent Net Worth Adjustments per Legal Decree 2.284/86 for Subsidiaries	
	<u>70,118</u>
Net Gain	<u><u>292,824</u></u>

NOTE 4. LOANS AND OTHER FINANCING EXTENDED

	12/31/86	2/28/86
Subsidiaries	3,970,558	2,893,693
Furnas Centrais Elétricas	<u>37,950,233</u>	<u>26,314,984</u>
	<u><u>41,920,791</u></u>	<u><u>29,208,677</u></u>

Loans and other financing extended to subsidiaries represent the balance of commercial transactions governed by long-term loan contracts with an open date at a rate of 1.8211 percent per month for the last six months. This rate was figured on the basis of the average cost of capital paid by Nuclebras during the preceding six months.

Credit extended to Furnas Centrais Elétricas, S.A., consists of the amount invoiced by Nuclebras for construction services and the delivery of nuclear fuel for Units 2 and 3 at the Almirante Alvaro Alberto Nuclear Power Plant under contracts signed on July 31, 1981, which fall due ten (10) years after the acceptance and transfer of ownership of the plant by the contractor.

These credits are subject to currency fluctuations equivalent to the weighted average for the preceding quarter for correction factors for capital obtained by Nuclebras and interest equivalent to the weighted average for the preceding quarter for costs incurred in repaying capital from third parties obtained by Nuclebras.

NOTE 5. INVESTMENTS

	Investments in Subsidiaries	Other	Total
Balance as of 12/31/1985	849,325	19,608	868,933
Additions over the Fiscal Year	-	87	87
Currency Correction	269,731	6,229	275,960
Adjustment of Net Worth of Investments	(74,042)	-	(74,042)
Currency Correction per CVM Directive No. 50	77,706	1,800	79,506
Adjustment of Net Worth of Investments per CVM Directive No. 50	70,118	-	70,118
Balance as of February 28, 1986	1,192,838	27,724	1,220,562
Additions over the Fiscal Year	2,032	423	2,455
Currency Correction per CVM Directive No. 57	240,697	5,631	246,328
Adjustment of Net Worth of Investments	(317,596)	-	(317,596)
Balance as of December 31, 1986	<u>1,117,971</u>	<u>33,778</u>	<u>1,151,749</u>

Additional Information on Investment in Subsidiaries and Affiliates

	NUCLAM	NUCLEI	NUCLEN	NUCLEP	NUCLEMON	NUSTEP
Subscribed and Paid Capital	66,711	534,833	8,967	1,417,717	44,848	984
Shares or Stock	34,023	360,597	6,725	1,392,122	44,847	492
Type of Stock	ON	ON	ON	ON	Shares	Shares
Net Worth	(45,651)	813,586	20,366	454,986	45,717	-
Ref. Date	12/31	12/31	12/31	12/31	12/31	
-						
% of Interest	51.00	75.00	75.00	98.20	99.99	50.00
Adjustment per Equivalent Worth	-	-	10,722	(320,899)	(7,419)	-
Profits (Losses) from 3/1/86 to 12/31/86	-	-	11,297	(326,781)	7,420	-

Loans and Credit						
Extended	53,159	2,669,221	(21,245)	1,261,692	7,731	-
Advances for Capital Improvement	2,249	-	-	-	1,144	3,854
Accts Payable	-	-	98,773	91,817	-	-
Receipts	376	460,054	-	206,768	1,062	711
Expenses	-	-	8,043	-	-	-

The financial statements of the subsidiaries and affiliates were reviewed by independent auditors.

The amounts receivable and payable indicated above represent operations involving the transfer of funds, the provision of goods and services and reimbursable expenses.

NOTE 6. IMMOVABLE ASSETS

		12/31/86 Corrected Depreciation and Amortization	2/28/86 Net Value	2/28/86 Net Value
	Corrected Cost			
Land	80,007	-	80,007	79,601
Buildings	538,382	102,673	435,709	376,715
Machinery, Equipment	1,274,308	537,424	736,884	662,529
Vehicles	15,794	11,958	3,836	4,840
Furniture, Fixtures	56,013	34,567	21,446	20,727
Leasehold Improvements	14,935	12,184	2,751	2,397
	<u>1,979,439</u>	<u>698,806</u>	<u>1,280,633</u>	<u>1,146,809</u>
Imports in Progress	41,515	-	41,515	574,250
Construction in Progress	709,298	-	709,298	34,150
Other Immovable Property	887	-	887	739
	<u>2,731,139</u>	<u>698,806</u>	<u>2,032,333</u>	<u>1,755,948</u>

Of the total depreciation in the amount of 122,392 cruzados, 52,605 cruzados was absorbed in production costs, 53,164 cruzados was charged to administrative expenses, 10,483 cruzados was entered under prospecting and research, 6,087 cruzados for service and equipment costs in progress was allocated for long-term assets to be reimbursed, and 53 cruzados was allocated to deferred items.

NOTE 7. DEFERRED ITEMS

	Corrected Cost	12/31/86 Corrected Amortization	Net Value	2/28/86 Net Value
Uranium Research and Prospecting Expenses	384,379	-	384,379	320,074
Poços de Caldas Project Expenses	2,634,477	2,073,982	560,495	792,499
Technical Information, Consultants, Training	810,561	202,980	607,581	563,530
Interest on Loans, Credits (Less Interest on Active Operations)	2,003,806	71,267	1,932,539	1,606,680
Net Currency Fluctuations and Currency Correction of Fixed Assets and Net Worth	-	-	-	(154,066)
Tax on Inflationary Profits	-	-	-	83,477
Other Expenses (Net Re- ceipts) to be Amortized	<u>140,830</u>	<u>140,651</u>	<u>179</u>	<u>53,001</u>
	<u>5,974,053</u>	<u>2,488,880</u>	<u>3,485,173</u>	<u>3,265,195</u>

NOTE 8. LOANS AND CREDIT OBTAINED

	December 31, 1986	February 28, 1986
Cruzados Payable in 1995, Subject to Cur- rency Correction, at Rates Varying from 7.8% to 24% per annum	14,432,915	6,949,749
Less Short-Term Loans and Credits	<u>(14,138,191)</u>	<u>(2,217,077)</u>
	<u>294,724</u>	<u>4,732,672</u>
Foreign Currency: \$739,461,000 (\$864,367,000 as of February, 1987), at 7.1875% to 9.375% per annum, payable in 1994	11,014,301	11,888,749
3,759,450,000 Deutsch Marks (DM 3,565,112,000 as of February, 1987), at 5.5% to 12.507%, payable in 2003	28,861,314	22,312,379
59,937,000 French Francs (FF 90,956,000 as of February, 1987), at 7.25% to 10.0% per annum, payable in 1991	139,122	185,062
8,530,000 Swiss Francs (SWFF 9,407,000 as of February, 1987), at 7.5625% per annum, payable in 1992	<u>78,385</u>	<u>69,685</u>
	<u>40,093,122</u>	<u>34,455,875</u>
Less Short-Term Loans and Credits	<u>(4,597,933)</u>	<u>(2,873,312)</u>
	<u>35,495,189</u>	<u>31,582,563</u>
	<u>35,789,913</u>	<u>36,315,235</u>

The Federative Republic of Brazil is the guarantor of the majority of the foreign-currency loans and credits.

NOTE 9. CAPITAL AND RESERVES

Subscribed and fully paid capital is represented by 43,779,325,036 shares of common stock and 29,186,216,690 shares of preferred stock valued at 56.45 cruzados per lot of 1,000 shares (28.00 cruzeiros per share as of February 28, 1986).

At this phase of capitalization, national credit for future capital improvement, which is shown under Long-Term Liabilities, is 2,111,406 cruzados, and when the authorized capital limit is raised, which is now in the process of approval, this amount will be added to corporate capital.

Capital reserves consist almost entirely of subsidies derived from the tax on liquid and gaseous fuels and lubricants and agreements to allocate said funds to (1) mineral prospecting and production and nuclear technology and (2) nuclear reactor units, which was done in 1981 and 1982, respectively.

NOTE 10. NET FINANCIAL RECEIPTS (EXPENSES)

	December 31, 1986	February 28, 1986
Financial Receipts		
Currency Fluctuations	9,934,289	5,553,202
Interest, Commissions and Taxes	<u>3,973,921</u>	<u>609,575</u>
	<u>13,908,210</u>	<u>6,162,777</u>
Financial Expenses		
Currency Fluctuations	4,144,370	7,009,729
Interest, Commissions and Taxes	<u>4,381,070</u>	<u>848,796</u>
	<u>8,525,440</u>	<u>7,858,525</u>
	<u>5,382,770</u>	<u>(1,695,748)</u>

These financial results do not include currency fluctuations in the amount of 3,403,904 cruzados (4,659,709,000,000 cruzeiros) on financing obtained and allocated to fixed assets, which are shown after the results of the currency correction of the balance.

Dear Directors of Empresas Nucleares Brasileiras, S.A. (Nuclebras):

1. We have audited the balance sheet of Empresas Nucleares Brasileiras, S.A. (Nuclebras) as of December 31, 1986, and related statements on the results, changes in net worth and the sources and allocations of funds during the fiscal year ending on said date. Our audit was performed in accordance with generally accepted auditing procedures and therefore included the verification of accounting records and such other auditing procedures as were deemed necessary under the circumstances.
2. Due to the changes introduced under Legal Decree 2.284/86, the statement of results, changes in net worth and sources and allocations of funds are being submitted separately from transactions that occurred before and af-

ter February 28, 1986, in accordance with current currency provisions. Our audit of the statements was conducted for the purpose of stating an opinion on operations for the fiscal year as a whole and not on any other periods of time taken individually.

3. We audited the special financial statements drawn up as of February 28, 1986, in accordance with the special standards stipulated by the Brazilian Accounting Institute (IBRACOM). Our audit did not find any departure from generally accepted accounting procedures.
4. In our opinion, the financial statements described in the first paragraph above reflect an accurate picture of the net worth and financial condition of Empresas Nucleares Brasileiras, S.A. (Nuclebras) as of December 31, 1986, as well as operating results, changes in net worth and sources and allocations of funds during the fiscal year ending on said date, and are in compliance with generally accepted accounting procedures, which were consistently applied throughout the preceding fiscal year.

Rio de Janeiro, February 19, 1987
BOUCINHAS, CAMPOS & CLARO, ACCOUNTANTS
CRC.SP - 5.528-S-RJ
Nilton Claro
Accountant, CRC-RJ-10.316-5

OPINION OF FISCAL COUNCIL

In accordance with current legislation and requirements stipulated in the bylaws, the Fiscal Council of Empresas Nucleares Brasileiras, S.A. (Nuclebras), has examined this Annual Report on the Company's operations and its financial statements, including the Balance Sheet, Operating Results, Statement of Changes in Net Worth, Statement of Sources and Allocations of Funds, explanatory notes to said financial statements, and the independent auditors' opinion for the fiscal year ended December 31, 1986.

On the basis of its review, the Fiscal Council is of the opinion that the areas audited do reflect an accurate picture of the net worth and financial condition of Nuclebras, and thus recommends that the General Shareholders' Meeting approve same in full.

Rio de Janeiro, March 19, 1987
CARLOS AUGUSTO LIMA BEZERRA
RAYMUNDO MENEZES DINIS
PAULO CABRAL DE ARAUJO
AUDITORS' OPINION

MINISTRY OF MINES AND ENERGY (MME)
EMPRESAS NUCLEARES BRASILEIRAS (NUCLEBRAS)

CONSOLIDATED STATEMENT
(Thousands of Cruzados)

	ASSETS	12/31/86	2/28/86
CURRENT ASSETS			
Cash and Bank Accounts		87,227	10,206
Financial Investments		237,941	188,376
Accounts Receivable		92,388	44,287
Deposits Committed to BACEN		31,395	29,546
Advances to Vendors		67,364	27,204
Cost of Reimbursable Services in Progress		21,036	-
Other		43,954	33,867
Inventory		262,955	200,885
Expenses for Following Fiscal Year		<u>11,950</u>	<u>59,149</u>
		<u>856,210</u>	<u>593,520</u>
LONG-TERM ASSETS			
Advance to NUSTEP		3,854	3,142
Services to be Invoiced		8,321,726	4,722,174
Cost of Reimbursable Services and Equipment in Progress		19,083	65,127
Credit Extended		37,950,233	26,314,984
Other		<u>230,920</u>	<u>189,362</u>
		<u>46,525,816</u>	<u>31,294,789</u>
FIXED ASSETS			
Investments		35,126	28,515
Immovable Property		5,968,849	5,039,305
Deferred Items		<u>4,322,929</u>	<u>3,869,314</u>
		<u>10,326,904</u>	<u>8,957,134</u>
		<u>57,708,930</u>	<u>40,845,443</u>
	LIABILITIES	12/31/86	2/28/86
CURRENT LIABILITIES			
Vendors		688,841	882,819
Credits and Loans Obtained		19,153,784	5,291,652
Wages and Social Benefits		938,558	620,452
Provision for Income Tax		2,677	10,967
Other		<u>229,174</u>	<u>211,805</u>
		<u>21,013,034</u>	<u>7,017,695</u>
LONG-TERM LIABILITIES			
Vendors		818,079	655,156
Credits and Loans Obtained		37,657,777	38,018,175
Federal Government Credits for Capital Improvement		2,111,406	685,004
Other		<u>21,115</u>	<u>21,115</u>
		<u>40,608,377</u>	<u>39,379,450</u>
RESULT FROM FUTURE FISCAL YEARS			
Receipts from Future Fiscal Years		<u>288,373</u>	<u>150,930</u>
		<u>288,373</u>	<u>150,930</u>

MINOR SHAREHOLDERS' INTEREST	194,312	163,410
NET WORTH		
Authorized Capital	4,137,287	2,052,023
Less Capital to be Subscribed	18,122	8,988
Capital Subscribed and Paid	4,119,165	2,043,035
Capital Reserves	4,882,244	5,452,425
Accumulated Losses	(13,396,575)	(8,580,269)
Losses for Period Ended 2/28/86	-	(5,316,589)
Economic Stabilization Program, Legal Decree 2.284/86	-	<u>535,356</u>
	<u>(4,395,166)</u>	<u>(5,866,042)</u>
	<u>57,708,930</u>	<u>40,845,443</u>

The explanatory notes are an integral part of these financial statements.

BOARD OF DIRECTORS

Licínio Marcelo Seabra, Chairman, CPF: 001.170.136-68
 José Pinto de Araújo Rabello, Executive Director, CPF: 290.227.387-87
 Jarbas Alberto di Piero Novaes, Director, CPF: 004.212.517-00
 Paulo Lima, Director, CPF: 010.024.497-15
 Rodolfo Paulo Gonçalves, Director, CPF: 006.948.357-49
 David Neiva Simon, Director, CPF: 007.834.717-34
 Fernando Antonio Salgado Henning, Director, CPF: 095.259.987-20

ACCOUNTING DEPARTMENT

Alex Borges Barreto, Accountant, CRC-RJ-46.679-9-S-DF-533, CPF: 363.500.367-00

Box at Upper Right

CONSOLIDATED STATEMENT OF THE SOURCE AND ALLOCATIONS OF FUNDS

SOURCE	March 1, 1986 to December 12, 1986 (thousands of cruzados)	January 1, 1986 to February 2, 1986 (millions of cruzeiros)
Shareholders		
Federal Credit for Future Capital Improvement	1,207,189	-
Capital Paid In	64	-
Third Parties		
Immovable Property and Deferred Items Trans- ferred to Current Assets	37,946	12,766
Subsidies for Investment	2,711	-
Long-Term Financing	1,463,544	3,449,737
Delivery of Goods and Services	58,388	138
Other	-	<u>1,238</u>
Total Sources	<u>2,769,842</u>	<u>3,463,879</u>

ALLOCATIONS

Operations

(Profits) Net Losses for Fiscal Year	(1,924,418)	5,319,551
Less: Charges not Considered Disbursements		
Writedown of Fixed Assets	18,349	5,370
Depreciation and Amortization	813,710	127,193
Currency Adjustment of Long-Term Indebtedness	6,041,043	10,563,040
Financial Charges on Long-Term Indebtedness	22,056	91,555
Plus: Receipts not Considered Cash Income		
Charges on Financing Extended	8,744,733	5,477,719
Currency Correction Credit	1,787,791	2,006,783
Currency Adjustment of Advances to Affiliate for Future Capital Improvement	711	997
Other Financial Receipts	4,434,731	50,132
	<u>6,148,390</u>	<u>2,068,024</u>
Fixed Assets		
Fixed Asset Acquisition	166,652	24,286
Increase in Deferred Items	229,663	105,902
Increase in Investment	774	85
	<u>397,089</u>	<u>130,273</u>
Other Allocations		
Increase in Cost of Reimbursable Services and Equipment	1,923,908	53,425
Long-Term Obligations Converted to Short-Term	8,028,189	168,585
Other	4,915	13,409
	<u>9,957,012</u>	<u>235,419</u>
Total Allocations	<u>16,502,491</u>	<u>2,433,716</u>
IMPROVEMENT (REDUCTION) IN NET WORKING CAPITAL FOR THE PERIOD	<u>(13,732,649)</u>	<u>1,030,163</u>

BREAKDOWN OF THE REDUCTION OF NET WORKING CAPITAL FOR THE FISCAL YEAR COMMENCED JANUARY 1, 1986, AND ENDED DECEMBER 31, 1986 (Thousands of Cruzados)

Balance as of February 28, 1986	1,030,163
From March 1, 1986, to December 31, 1986	(13,732,649)
Effect on Net Working Capital of Adjustments under the Economic Stabilization Program	(3,410)
Reduction of Net Working Capital	(12,705,896)

Represented by:

	(Thousands of Cruzados)		
	12/31/86	12/31/85	Change
Current Capital	856,210	400,294	455,916
Current Liabilities	<u>21,013,034</u>	<u>7,851,222</u>	<u>13,161,812</u>
	(20,156,824)	7,450,928	(12,705,896)

The explanatory notes are an integral part of these financial statements.

CONSOLIDATED STATEMENT OF INCOME

	March 1, 1986 to December 12, 1986 (thousands of cruzados)	Reclassified January 1, 1986 to February 2, 1986 (millions of cruzeiros)
Gross Receipts from Sales of Services and Products	811,398	27,641
Less: Returns, Rebates, and Taxes on Sales and Services	122,895	2,083
Net Receipts from Sales of Services and Products	688,503	25,558
Cost of Products and Services Sold	167,172	18,349
Gross Operating Profits	521,331	7,209
Operating Expenses (Receipts)		
Administrative	603,823	102,091
Manufacturing Costs	70,805	10,569
Financial Costs	(4,639,235)	2,296,263
Prospecting and Research	161,937	14,762
Amortization of Deferred Assets	708,664	115,247
Administrators' Fees	5,734	739
Other Operating Revenue	-	(25)
	(3,088,272)	2,539,646
Net Operating Profits (Losses)	3,609,603	(2,532,437)
Net Non-Operating Revenue (Expenses)	32,385	(887)
	3,641,988	(2,533,324)
Currency Correction of the Balance		
Net Worth	321,858	430,736
Fixed Assets	1,465,933	1,576,046
	1,787,791	2,006,782
Currency Fluctuations on Financing for Immovable Property	3,502,678	4,793,009
	(1,714,887)	(2,786,227)
Profits (Losses) Before Income Taxes	1,927,101	(5,319,551)
Income Taxes	2,683	-
	1,924,418	(5,319,551)
Minority Shareholders' Interest	3,058	2,962
	1,927,476	(5,316,589)

BREAKDOWN OF NET LOSSES FOR THE FISCAL YEAR
COMMENCED JANUARY 1, 1986, AND ENDED DECEMBER 31, 1986
(Thousands of Cruzados)

Results for the Period	
Two Months Ending February 28, 1986	(5,316,589)
Ten Months Ending December 31, 1986	1,927,476
Results for the Fiscal Year Before Adjustments	(3,389,113)
Adjustments per Economic Stabilization Program (Legal Decree 2.284/86)	535,356
Net Losses for the Fiscal Year	(2,853,757)

The explanatory notes are an integral part of these financial statements.

EXPLANATORY NOTES TO FINANCIAL STATEMENTS
(thousands of cruzados)

NOTE 1. OPERATIONS

Empresas Nucleares Brasileiras (NUCLEBRAS) is a semi-private corporation chartered to implement the Federal monopoly in the nuclear energy sector. Its purposes are mineral prospecting, the production of uranium concentrate, the development and installation of a conversion unit, ore enrichment, the manufacture of a reactor unit, the development of a reprocessing unit, and the construction of nuclear power plants. It shall also provide all engineering services and the equipment and materials needed to build, assemble and operate said plants, including the financing of construction and the manufacture of the reactor unit.

The pace of the Company's operations has been held to a minimum, in part due to the process of re-evaluating Nuclebras' participation in the Brazilian nuclear program as set forth in Position Paper No. 009/86 of August 1, 1986, and approved by the president of the Republic, and in part due to the shortage of funds available to carry out the program and reach the goals by the dates planned. The repeated delays that have been experienced have significantly affected operating costs and are contributing to increased indebtedness, which has been aggravated by a lack of the necessary capital.

The negative net working capital condition is due to the fact that the amounts receivable from the financing of construction and the provision of fuel for Units 2 and 3 at the Admiral Alvaro Alberto Nuclear Power Plant, which are the principal assets, will be realizable upon delivery of the units ready to operate, which is scheduled for 1992 and 1995, respectively, i.e., a long-term arrangement, with maturity dates that are poorly coordinated with the largest liability, which consists of the loans and financing obtained from third parties, which were used to perform contracted services, and portions of these loans have short-term due dates. Aggravating the situation still further is the fact that these have almost all been renegotiated on short-term arrangements.

The Nuclear Industry Recovery Plan, now under way, should make it possible to formulate measures for improving financing and obtaining the long-term financing necessary to carry out the projects for which Nuclebras is responsible.

NOTE 2. CONSOLIDATION PROCEDURES

For consolidation purposes, the following subsidiaries are included, in addition to the parent company:

	% OF INTEREST IN 1986	OPERATIONAL PHASE IN 1986
Nuclebras Equipamentos Pesados, S.A. (NUCLEP)	98.20	In Operation
Nuclebras Enriquecimento Isotopico, S.A. (NUCLEI)	75.00	In Construction
Nuclebras Auxiliar de Mineracao, S.A. (NUCIAM)	51.00	Pre-Operational
Nuclebras de Monazitas e Associados, Ltda. (NUCLEMON)	99.99	In Operation
Nuclebras Engenharia, S.A. (NUCLEN)	75.00	In Operation

Among the procedures followed in drawing up the consolidated financial statements, the following should be pointed out:

- a. The accounts payable and receivable among the companies included were not included.
- b. Receipts, disbursements and results of operations performed among said companies were not included.
- c. Nuclebras' investments in its subsidiaries and the corresponding funds comprising said subsidiaries' net worth were not included.
- d. The results of valuations effected by the equivalent worth method were not included.
- e. Disclosure of minority shareholders' interest in Nuclebras' net worth and statement of results.

A comparison between Nuclebras' net results and net worth with the consolidated net results and net worth as of December 31 and February 28 gives the following information:

	NET PROFITS (LOSSES)		NET WORTH	
	12/31/86	2/28/86	12/31/86	2/28/86
Parent Company's Condition	1,714,334	(5,653,763)	(1,451,134)	(3,532,021)
Adjusted for Intercompany Transactions for Consolidation Purposes Only:				
Currency Correction on Investments in Affiliates in Pre-Operational Phase	(102,081)	(114,520)	(561,741)	(459,659)
Portion of Profits in Cost of Services in Progress and Costs of Future Fiscal Years				
Current Fiscal Year	(60,901)	(11,688)	(60,901)	(11,688)
Previous Fiscal Years			(127,290)	(115,602)
Financial Earnings Received by Parent Company from NUCLAM and NUCLEI	(474,109)	(382,767)	(2,166,879)	(1,692,770)
Currency Correction on Accumulated Losses on Financial Receipts from NUCLAM and NUCLEI	830,996	845,981	-	-
Other	<u>19,237</u>	<u>160</u>	<u>(27,221)</u>	<u>(53,502)</u>
Consolidated Condition	<u>1,927,476</u>	<u>(5,316,589)</u>	<u>(4,395,166)</u>	<u>(5,866,042)</u>

NOTE 3. MAIN ACCOUNTING PROCEDURES

- a. The financial statements have been drawn up and submitted in accordance with Public Law No. 6.404/76, taking into account the modifications effected under the Economic Stabilization Plan as explained under Note 4.
- b. The results have been verified in accordance with the requirements in effect for the fiscal year as follows:
 - Revenue earned during the fiscal year and costs, expenses and charges incurred during the fiscal year, regardless of receipts or payments, with the exception of items related to the provision of goods and services for construction of the nuclear power plants, which are accumulated under Long-Term Assets;
 - Net effects of currency correction on fixed assets and net worth and currency or exchange fluctuations, at official rates, on current and long-term assets and liabilities;
 - Charges for depreciation of immovable property and amortization of deferred items;
 - Earnings and losses from participation in subsidiaries.
- c. Assets and liabilities due within 360 days are considered current.
- d. Investments [represented by treasury bills (OTNs)] are entered under the cost of acquisition plus earnings due as of the close of the fiscal year.
- e. Inventory was entered at the average cost of acquisition, which is less than the market price or net selling price. Imports in progress were entered as identified costs incurred as of the date of the balance.
- f. Fixed assets were entered at the corrected cost of construction or acquisition. Depreciation was figured by the linear method as follows: buildings, twenty-five (25) years; machines and equipment, ten (10) years; furniture and fixtures, ten (10) years; and vehicles, five (5) years.
- g. Deferred items are shown at cost plus currency correction and were amortized by the linear method over five (5) years through 1987, with the exception of preliminary costs for the second operating phase of the Poços de Caldas Industrial Mining Complex, whose amortization commenced in January of 1985 and extends over ten (10) years. Expenses incurred after 1984 will be amortized through 1994.

NOTE 4. EFFECTS OF THE CHANGE FROM CRUZEIRO TO CRUZADO AND THE LOSS OF PURCHASING POWER

In 1986 the effects of the loss of purchasing power suffered by Brazilian currency under the Economic Stabilization Plan, which converted the cruzeiro into the cruzado, were as follows:

a. Format of Financial Statements

Due to the Economic Stabilization Plan, which became law under legal Decree No. 2.284/86 and, among other things, converted the cruzeiro into the cruzado, special financial statements were drawn up as of February 28, 1986, in accordance with the procedures set forth in CVM Directives Nos. 48 and 50.

The financial statements as of December 31, 1986, were drawn up and submitted in accordance with the provisions set forth under CVM Guidelines

No. 11 of September 15, 1986, CVM/DTE Circular Letter No. 309 of December 17, 1986, CVM Directive No. 59 of December 22, 1986, and CVM Guidelines No. 12 of January 12, 1987.

b. Currency Correction of Fixed Assets and Net Worth

The fixed asset and net worth accounts were adjusted in accordance with official indices and revised as follows:

The variation in the value of ORTNs [Brazilian Treasury bills] between December of 1985 (70,613.67 cruzeiros) and February of 1986 (93,039.40 cruzeiros) was entered directly against the fiscal year results under the account for Currency Correction of Fixed Assets and Net Worth.

The variation in the value of ORTNs between February 1986 and OTNs prorated to February 28, 1986 (99.50 cruzados) entered in the asset suspense account for Adjustments due to the Economic Stabilization Program per Legal Decree 2.284/86 was transferred to the results for the fiscal year per CVM Directive No. 50.

The variation in the value between OTNs prorated to February 28, 1986, and OTNs prorated to December 31, 1986 (119.49 cruzados) was entered directly against results for the fiscal year under the account for Currency Correction of Fixed Assets and Net Worth per CVM Directive No. 57.

c. Adjustment of Assets and Liabilities

Balances in the accounts for current and long-term assets and current and long-term liabilities, which were affected by Legal Decree 2.284/86, were deflated as of February 28, 1986, and the results of this deflation were entered in an asset suspense account (Adjustments per Legal Decree 2.284/86) and finally transferred to the results at the close of the fiscal year.

Assets and liabilities subject by contract or law to subsequent currency fluctuations based on OTNs, if maturing after February 28, 1987, were revised proportionally based on the value of OTNs prorated to December 31, 1986, and the adjustments were entered directly against fiscal year results per CVM Directive No. 57.

In order to grasp the effects of these adjustments better, a statement of the account for Adjustments Effected under Legal Decree 2.284/86 is given below:

Earnings from the Conversion of Obligations Without a Currency		
Correction Clause:	Obligations to Vendors	780
	Other Obligations	<u>290</u>
		<u>1,070</u>
Losses from the Conversion of Obligations Without a Currency		
Correction Clause:	Accounts Receivable from Customers	48
	Other Accounts Receivable	<u>783</u>
		<u>831</u>
Earnings from Accounts Receivable with a Currency		
Correction Clause:	Income Taxes	1,682
	Other Charges	<u>1,150</u>
		<u>2,832</u>

Expenses from the Revision of Accounts Payable With a Currency Correction Clause		
Financing		29,244
Other Obligations		46,017
Provision for Income Taxes for Fiscal 1985		<u>1,291</u>
		<u>76,552</u>
Receipts from Adjustment of Provisions		
Bad Accounts		1
Special Currency Correction		
Fixed Assets		421,747
Net Worth		<u>188,139</u>
		<u>609,886</u>
		<u>536,406</u>
Minority Interest		(1,050)
Net Earnings		<u>535,356</u>

NOTE 5. LOANS AND OTHER FINANCING EXTENDED

Credit extended to Furnas Centrais Elétricas, S.A., consists of the amount invoiced by Nuclebras for construction services and the delivery of nuclear fuel for Units 2 and 3 at the Almirante Alvaro Alberto Nuclear Power Plant under contracts signed on July 31, 1981, which fall due ten (10) years after the acceptance and transfer of ownership of the plant by the contractor.

These credits are subject to currency fluctuations equivalent to the weighted average for the preceding quarter for correction factors for capital obtained by Nuclebras and interest equivalent to the weighted average for the preceding quarter for costs incurred in repaying capital from third parties obtained by Nuclebras.

NOTE 6. IMMOVABLE ASSETS

		12/31/86		2/28/86
	Corrected	Corrected		
	Cost	Depreciation and Amortization	Net Value	Net Value
Land	308,686	-	308,686	270,022
Buildings	1,095,586	213,623	881,963	759,993
Machinery, Equipment	2,171,493	887,012	1,284,481	1,140,210
Vehicles	28,768	22,871	5,897	7,340
Furniture, Fixtures	98,930	63,143	35,787	34,710
Leasehold Improvements	25,983	18,451	7,532	6,287
Campos Warehouse	5,528	332	5,196	4,481
Other	553	-	553	461
	<u>3,735,527</u>	<u>1,205,432</u>	<u>2,530,095</u>	<u>2,223,504</u>
Imports in Progress	344,423	-	344,423	309,509
Construction in Progress	3,066,106	-	3,066,106	2,466,747
Other Immovable Property	<u>28,225</u>	<u>-</u>	<u>28,225</u>	<u>39,545</u>
	<u>7,174,281</u>	<u>1,205,432</u>	<u>5,968,849</u>	<u>5,039,305</u>

Of total depreciation for the fiscal year in the amount of 173,770,000 cruzados, 83,999 cruzados was debited against results, of which 3,500,000 cruzados is shown under Manufacturing Costs not Applied to Production, 49,018,000 cruzados was charged to Inventory, 6,087,000 cruzados was charged to the cost of reimbursable services and equipment in progress, 919,000 cruzados was charged to deferred items and 33,747,000 cruzados was charged to cost of production.

NOTE 7. DEFERRED ITEMS

	Corrected Cost	12/31/86 Corrected Amortization	Net Value	2/28/86 Net Value
Uranium Research and Prospecting Expenses	469,162	-	469,162	329,757
Poços de Caldas Project Expenses	2,634,477	2,073,982	560,495	792,500
Technical Information, Consultants, Training	946,294	271,874	674,420	630,458
Interest on Loans, Credits (Less Interest on Active Operations)	(157,766)	(71,267)	(229,033)	(86,091)
Non-Production Costs	536,187	106,743	429,444	394,467
Net Currency Fluctuations and Currency Correction of Fixed Assets and Net Worth	1,731,489	276,776	1,454,73	968,427
Tax on Inflationary Profits	-	-	-	83,477
Organizational, Administra- tive, Other Expenses	1,552,721	352,787	1,199,934	1,012,728
Economic Stabilization Program Adjustment	(236,206)	-	(236,206)	(236,409)
	<u>7,476,358</u>	<u>3,153,429</u>	<u>4,322,929</u>	<u>3,889,314</u>

NOTE 8. LOANS AND CREDIT OBTAINED

	December 31, 1986	February 28, 1986
Cruzados Payable in 1995, Subject to Cur- rency Correction, at Rates Varying from 6% to 23.83% per annum	14,631,497	7,099,831
Less Short-Term Loans and Credits	(14,197,328)	(2,229,917)
	434,169	4,869,914
Foreign Currency: \$745,249,000 (\$871,567,000 as of February, 1986), at 0.0875% to 26.8% per annum, payable in 1994	11,101,079	11,988,400
4,019,087,000 Deutsch Marks (DM 3,817,160,000 as of February, 1986), at 1.375% above LIBOR to 11.4%, payable in 2003	30,861,478	23,966,849

59,937,000 French Francs (FF 90,956,000 as of February, 1986), at 7.25% to 10.2% per annum, payable in 1992	139,122	185,062
8,530,000 Swiss Francs (SWFF 9,407,000 as of February, 1986), at 7.5625% per annum, payable in 1992	<u>78,385</u>	<u>69,685</u>
	42,180,064	36,209,996
Less Short-Term Loans and Credits	<u>(4,956,456)</u>	<u>(3,061,735)</u>
	<u>37,223,608</u>	<u>33,148,261</u>
	<u>37,657,777</u>	<u>38,018,175</u>

The Federative Republic of Brazil is the guarantor of the majority of the foreign-currency loans and credits.

NOTE 9. CAPITAL AND RESERVES

Subscribed and fully paid capital is represented by 43,779,325,036 shares of common stock and 29,186,216,690 shares of preferred stock valued at 56.45 cruzados per lot of 1,000 shares (28.00 cruzeiros per share as of February 28, 1986).

At this phase of capitalization, federal credit for future capital improvement, which is shown under Long-Term Liabilities, is 2,111,406 cruzados, and when the authorized capital limit is raised, which is now in the process of approval, this amount will be added to corporate capital.

Capital reserves consist almost entirely of subsidies derived from the tax on liquid and gaseous fuels and lubricants and agreements to allocate said funds to (1) mineral prospecting and production and nuclear technology and (2) nuclear reactor units, which was done in 1981 and 1982, respectively.

NOTE 10. NET FINANCIAL RECEIPTS (EXPENSES)

	December 31, 1986	February 28, 1986
Financial Receipts		
Currency Fluctuations	9,475,007	5,021,262
Interest, Commissions and Taxes	<u>3,977,583</u>	<u>611,185</u>
	<u>13,452,590</u>	<u>5,632,447</u>
Financial Expenses		
Currency Fluctuations	4,166,332	7,056,981
Interest, Commissions and Taxes	<u>4,647,023</u>	<u>871,729</u>
	<u>8,813,355</u>	<u>7,928,710</u>
	<u>4,639,235</u>	<u>(2,296,263)</u>

These financial results do not include currency fluctuations in the amount of 3,502,678 cruzados (4,793,000,000,000 cruzeiros) on financing obtained and allocated to fixed assets, which are shown after the results of the currency correction of the balance.

Dear Directors of Empresas Nucleares Brasileiras, S.A. (Nuclebras):

1. We have audited the consolidated balance sheet of Empresas Nucleares Brasileiras, S.A. (Nuclebras), and its affiliates as of December 31, 1986, and related consolidated statements on the results, changes in net worth and the sources and allocations of funds during the fiscal year ending on said date. Our audit was performed in accordance with generally accepted auditing procedures and therefore included the verification of accounting records and such other auditing procedures as were deemed necessary under the circumstances.
2. Due to the changes introduced under Legal Decree 2.284/86, the consolidated statement of results, changes in net worth and sources and allocations of funds are being submitted separately from transactions that occurred before and after February 28, 1986, in accordance with current currency provisions. Our audit of the statements was conducted for the purpose of stating an opinion on operations for the fiscal year as a whole and not on any other periods of time taken individually. The special consolidated financial statements as of February 28, 1986, have not been reviewed by independent auditors, but are shown here for the purposes of comparison only.
3. In our opinion, the consolidated financial statements described in the first paragraph above reflect an accurate picture of the net worth and financial condition of Empresas Nucleares Brasileiras, S.A. (Nuclebras), and its affiliates as of December 31, 1986, as well as operating results, changes in net worth and sources and allocations of funds during the fiscal year ending on said date, and are in compliance with generally accepted accounting procedures, which were consistently applied throughout the preceding fiscal year.

Rio de Janeiro, February 19, 1987
BOUCINHAS, CAMPOS & CLARO, ACCOUNTANTS
CRC.SP - 5.528-S-RJ
Nilton Claro
Accountant, CRC-RJ-10.316-5

8844

CSO: 5100/2089

BRAZIL

LATIN AMERICA

GOVERNMENT WILL NOT BUILD MORE NUCLEAR PLANTS

PY261858 Brasilia Radio Nacional da Amazonia Network in Portuguese 1000 GMT
26 May 87

[Text] The Brazilian Government does not intend to begin building any new nuclear plants within the next few years. This statement was made by Camilo Penna, president of the Brazilian Furnas Electric Power Plants, Inc. [FCE], who said that the conclusion of the construction of nuclear plants Angra II and Angra III is expected by the end of 1994.

Reporter Leonard Oliveira has further details on the subject.

[Begin recording] [Oliveira] The decision to continue the Brazilian nuclear program is restricted to the completion of the Angra II and Angra III nuclear plants, scheduled for 1992 and 1994, respectively. This report was released by FCE President Camilo Penna, following the presidential decision to complete the plants currently under construction.

[Camilo Penna] President Sarney has already made the decision to continue the nuclear program, which includes the conclusion of the construction of Angra II and Angra III. After that, Brazil will not begin to build any other nuclear plant. The general consensus is that what is under construction must be concluded. This construction is in a very advanced stage. In the case of Angra II, for example, 75 to 80 percent of the work has been completed, while in the case of Angra III, 50 percent of the work is finished. So, there is no sense in abandoning them. They will be completed and they will be very important for our nuclear program.

[Oliveira] On stressing the importance of the Brazilian atomic program, Camilo Penna said that the power produced by Angra I at full power has prevented a total blackout throughout the state of Rio de Janeiro over the past few days, following the collapse of transmission lines in the southern part of the country.

Camilo Penna added that Angra I has been working at full power over the past 2 months within the international standards of quality. [end recording]

/8309

CSO: 5100/2101

THERMONUCLEAR FUSION RESEARCH PROGRAM TO BE FORMULATED

Brasília BRASIL CIENCIA in Portuguese 11-20 Apr 87 p 4

[Text] Brazil is the only country in Latin America and one of the first in the Third World to set up a thermonuclear fusion research program. On 8 April Minister Renato Archer empaneled a Working Group to develop the Brazilian Plasma and Controlled Thermonuclear Fusion Research Program. This group will also be in charge of planning a plasma laboratory to be opened within the next 3 years at a site yet to be determined.

Nuclear fusion is considered a promising solution for the serious energy shortage predicted in the next century. Unlike the conventional method of generating atomic energy based on the fission of uranium and other rare elements, the new method uses a raw material that abounds in Nature: hydrogen.

Another advantage is lower risk for the environment. Fusion produces less nuclear waste, and with a half life (the average length of time required to lose radioactivity) of about 15 years, vs. over 100 years for fission.

Renelson Ribeiro Sampaio, MCT planning and program coordinator, will coordinate the Working Group, consisting of Adrian Ricardo Levinson (CNPq), Reinaldo Guimaraes (FINEP), Gerson Otto Ludwig (INPE), Ivan Cunha Nascimento (USP), Paulo Hirosh Sakanaka (UNICAMP), Candido da Cunha Raposo (UPF), Darcy Dillenburg (UFRGS), and Jose Pantuso Sudano (CTA).

The USA and the USSR are currently in the forefront of nuclear fusion research, followed by the European Community, China and India. Brazil is the first in Latin America to set up a program in this field.

BB44

CSO: 5100/2094

BRIEFS

SBPC ANTI-NUCLEAR ARMS DOCUMENT--Prohibition of the manufacture, shipment and stockpiling of nuclear weapons is the main recommendation that the Brazilian Society for Progress in Science (SBPC) would like to see embodied in Brazil's new Constitution. According to the coordinator and founder of the SBPC, the anti-bomb proposal will be brought up with the framers of the Constitution tomorrow as the latest pressure move to protect the environment. The society believes that nuclear energy is innovative and satisfactory, but that in order to avoid abuses, it should be subject to approval by the National Congress and a referendum by the people. As far as the manufacture of atomic bombs is concerned, the group is totally against Brazil's participation in this area and promises to send the framers of the Constitution a statement signed by 100,000 people who oppose nuclear weapons in Brazil. In addition, the Society for Progress in Science will also submit environmental protection recommendations on the conservation of strategic minerals under the auspices of the government, redirecting research into an effort to discover renewable natural resources. The society also defends the market reserve to protect Brazilian computer, biotechnology and chemical companies, and asks the state to become a real source of social good for the benefit of the Brazilian people as a whole, providing basic health and educational services. [Excerpt] [Manaus JORNAL DO COMERCIO in Portuguese 19-21 April 87 p 5] 8844

NUCLEN STRIKE--The 800 employees of Nuclebras Engenharia (NUCLEN) go on strike at midnight tonight, shutting down offices in Rio and Angra dos Reis. They rejected the company's wage offer in a meeting last night. Their main demands are 100 percent of IPC; a real salary increase of 22.32 percent; a wage floor of 6,392.00 cruzados; 10.9 percent productivity; and shortening the working day at Angra to a 40-hour week. The company is offering 100% IPC, a three percent real wage increase, a wage floor of 3,500.00 cruzados and a 42.5-hour work week. [Excerpt] [Rio de Janeiro O GLOBO in Portuguese 29 Apr 87 p 24] 8844

URANIUM MINING CONTRACT COMPETITION--Yesterday in Fortaleza Ariosto Holanda, the Ceara secretary of industry and trade, said that Petrofertil, a Petrobras subsidiary, will announce on the 20th the results of the bidding held 12 January for exploring the Itataia uranium deposit, located in the municipality of Santa Quitéria in the north central part of the state, where Nuclebras had awarded exploration rights to Petrofertil. The bidders are Promon Engenharia, Paulo Abid Engenharia, Natron Consultoria e Projetos, Internacional de Engenharia and Milder Kaiser Engenharia. The winning bidder is to become a minority partner with Petrofertil to explore the deposits. According to Holanda, the undertaking will require an investment on the order of \$250 million. Its purpose is to explore phosphorus-bearing rock with the goal of mining 1,000 metric tons a year of uranium oxide and 110,000 metric tons a year of phosphoric acid. The Ceara secretary of industry and trade said that Itataia will supply fertilizer requirements for the irrigation project in the Northeast and other similar projects, in addition to providing the Angra I and Angra II nuclear power plants with uranium oxide. Holanda mentioned that Ceara currently has the nation's largest uranium reserves and that Nuclebras has been studying the Itataia deposit since 1975. About \$20 million has already been invested, primarily in geological studies, mineral exploration and infrastructure. Holanda also pointed out that the Itataia ore contains 10 times more uranium than phosphorus-bearing rocks normally have. This has required the development of special technology to extract the uranium and phosphoric acid (a solvent extraction process). [Text] [Sao Paulo GAZETA MERCANTIL in Portuguese 16 April 87 p 22] 8844

CSO: 5100/2094

CONCERN INCREASES OVER RADIATION-CONTAMINATED FOOD

London AL-HAWADITH in Arabic 3 Apr 87 p 46

[Article by Usamah 'Ajja: "The Case of Radioactive Dairy Products: Is It Political or Social?"]

[Text] Cairo's situation could be the title for a melodramatic movie called "Terror Overtakes the City." Over 2 months ago, all hell broke loose in the Egyptian capital, and strange names and hard scientific data began finding their way into every Egyptian home with every meal and every glass of milk consumed by children in a country whose official statistics show that it imports 75 percent of its food from abroad. Every Egyptian mother, even the illiterate ones who can only claim the "virtue of hearing," are trying to find out what happened in Chernobyl, what are the permissible annual radioactive doses that the human body can absorb, and what are the possible effects of radiation on children, after discovering that a radioactive shipment of dairy products from West Germany had entered Egypt and was being consumed.

The case entered the arena of the Egyptian political campaign, and NPUG, one of the opposition parties, raised the electoral slogan "No to the Children Killers, No to the Importers of Contaminated Milk." It then entered the realm of partisan competition when certain opposition sources accused the son of a senior official of being behind the deal, while other sources affirmed that the Ministry of Supply itself had imported the contaminated shipment. A third source firmly believed that Jewish companies were behind the importation of contaminated food as part of a plan overseen by the Israeli Mosad.

What added the most mystery to the matter was the absence of any statement identifying the source that imported the contaminated milk products, even if they did not get to Egypt!

The story began when a Soviet nuclear reactor in Chernobyl exploded last April. Although it is thousands of kilometers away from Cairo, its "blessings" reached Egypt and a large number of other countries of the world via nuclear radiation and, consequently, radioactive food. The prices of such commodities began to plummet with the aim, of course, of dumping them. Egypt actually suspended the shipment of foodstuffs from the Soviet Union, Romania, Turkey, and East Germany from May through July of last year, particularly shipments of live cattle, dried fruits, dried milk and sugar. Data put out by the Egyptian Chamber of Commerce said that Turkish lentils were being offered at less than half price, and cusin, which cost 8,000 Egyptian pounds in Egypt, was being sold for only \$1,000 a ton.

It appears that the story had another side to it. The German Ministry of Health condemned the exportation of contaminated dried food to a number of Third World countries, believed to include Egypt, calling it an "immoral act." Reuter News Agency last December confirmed the news when it reported that a number of radioactive dried milk shipments were under negotiation for export to some Third World countries, among them Egypt! The German Ministry for Environment confirmed these reports when it announced that 3,000 tons of highly-contaminated dried milk had been sold to Egypt and that geiger counters in Germany indicated the level of radiation at ten times more than the permissible limit!

A German company, "Milchi," had received a DM 3.5 million reimbursement from the German government for losses incurred by contaminated dried milk products, but the company was not content with that and sought to increase its profits by selling the "deal of death" to some businessmen in developing countries, among them Egypt and Angola. To conceal the crime, a deal was struck with a new company, "Lopex Export," to expedite the deal after storing the dried milk in deserted railroad cars for 8 months. The bid was awarded for LE 100,000 to a still unidentified Egyptian businessman who sold it to three other merchants for LE 3 million.

In the face of such information, the Egyptian government changed direction when it accused the German Ministry for Environment of rashness in making the announcement, pointing out that contacts by the Egyptian Foreign Ministry revealed that the matter was related to a shipment of dried whey used as fodder, and that allegations about deals being concluded and delivered were false. It emphasized through Ambassador Fikri Nakhlah, deputy director of the economic affairs department at the foreign ministry, that the ministry's instructions to all diplomatic missions banned the importation of any food products without a certificate from the exporting country certified by the Egyptian mission in that country, stating that the goods are free of contamination. Egyptian Prime Minister Dr 'Atif Sidqi said that the contaminated shipments filled 100 railroad cars destined for Angola, 50 of which were in Cologne destined for Cairo, but Belgian authorities refused them entry. Dr 'Atif Sidqi affirmed that no radioactive food products have entered Egypt after the Chernobyl incident, because shipments coming into the country are checked with Geiger counters belonging to the Nuclear Energy Commission

[NEC]. He pointed out that the government is greatly concerned about citizens' health and will not cover up any deviation anywhere. He confirmed that 50 samples from each shipment are analyzed and checked for safety.

Egyptian government sources pointed out that massive precautions have been adopted in the wake of the Chernobyl incident to keep out any contaminated products. The former minister of economy issued Decree No 191 of 1986 on 14 May of last year banning the importation of any food products not accompanied by an official certificate of non-contamination from the country of origin and certified by the Egyptian embassy. Furthermore, according to Ministry of Health Decree No 203 of 1986, all food shipments from abroad, East Europe in particular, must be checked for radiation before they are released by sending samples to the National Research and Radiation Technology Center in Nasr City (Cairo) for testing. Dr 'Abdallah Mahmud, professor of nutrition at the NEC, said that the human body can tolerate an internationally-recognized rate of radioactive material, and the NEC formed a committee to test that rate and criteria. Committee scientists agreed that the constitution of the Egyptian body can tolerate radioactive concentrations of 370 Becquerels (units of radiation) for every liter of milk or every kilogram of food for children and 600 Becquerels for every kilogram of other commodities. It was agreed that the annual radiation dose absorbed by the human body through food would not exceed 5 percent of the internationally observed limits of radioactive exposure through medical, industrial, and research applications. This rate was set following a study of Egyptian eating habits that established that individual daily consumption amounts to 200 grams of dairy products and 1 kg of food.

All these government measures notwithstanding, Egyptians remain uneasy about using milk, chocolate, or butter. Measures adopted by Egypt, according to the Egyptian prime minister, confirm that out of 5,000 shipments of foodstuffs, only 4 proved to be contaminated. The Alexandria Port Authority that handles 90 percent of the Egyptian foreign trade traffic, including 6 million tons of food, confirmed that a Dutch ship carrying a 61 ton shipment of contaminated dairy products from Vienna was ordered out of Alexandria harbor, under Egyptian naval guard to ensure its departure; and 3,886 tons of powdered milk and butter shipped from Belgian and West German ports were confiscated for failing to produce a certificate of non-contamination from the country of origin.

Some shipments have been inspected by the Egyptian prosecutor's office, and the West Cairo prosecutor's office is investigating the importation of 3 contaminated shipments of 3.5 tons of Tilia herbs, 20 tons of hazel nuts, and 61 tons of milk products that proved to be contaminated and were sent back to sea. These shipments had been imported for the private sector. Moreover, Port Sa'id prosecution is investigating a businessman who had imported 200 tons of macaroni, of which 1,360 boxes were marketed before the shipment was checked for contamination and subsequently proven to be radioactive. Egyptian authorities could only recover 700 of these boxes!

The amazing thing is that all these crimes related to the importation and marketing of contaminated goods are subject to a number of old laws prescribing 6 months to 3 years jail sentence and a fine of 100 to 1,000 Egyptian pounds. The legislature never imagined that one day modern-day crimes might produce a totally maimed generation or several thousand cases of cancer.

12502

CSO: 5100/4610

NUCLEAR ACCIDENT IN 1976 ACKNOWLEDGED

Tel Aviv MA'ARIV in Hebrew 17 Apr 87 p 5

[Article by Tal Shahaf and Ronnie Sofer: "Technician Injured by Radiation at Nahal Soreq Nuclear Plant Awarded 50,000 New Shekel"]

[Text] The state has acknowledged responsibility for an accident that occurred in 1976 at the Nahal Soreq nuclear plant, and paid 50,000 New Shekel in compensation to a technician who had been injured in that accident. The technician had been exposed to radiation in the magnitude of thousands rad while holding in his hand a powerful radioactive element. In 1980 an expert determined that the technician, H.P. from Holon, who was injured in his fingers, was in danger of developing cancer at any time throughout his life, losing two fingers, suffering recurring infections, and contracting malignant diseases as a result of lowered immune resistance caused by the radiation.

Informed sources claim that the Nahal Soreq accident was caused by personnel negligence. According to them, one technician left a radioactive source open, and the injured H.P. proceeded to his assigned work without realizing the situation; thus, he was exposed to dangerous radiation for a few minutes. The same sources also asserted that 1 year previously a worse case had occurred; on that occasion, compensation was paid to the person injured without legal proceedings. In the wake of the more recent case, an internal commission of investigation was established, and its findings brought about the dismissal of two workers.

No official reaction was available from the Nahal Soreq nuclear plant because of the Pesah holiday. One of the plant scientists, who asked to remain anonymous, explained that accidents such as that normally do not occur because of the strict work regulations. According to him, technicians do not deviate from those regulations. "If anyone here deviates from the regulations, then it is the scientists," the scientist stated, and added: "The only tragedy that happened in the 30 years of existence of the plant was that one worker was electrocuted during the erection of the building." He also added that a catastrophe such as the one at Chernobyl could not happen there, because the plant is a five megawatt research plant, as compared to 100 megawatt at the Soviet Union plant.

The technician who was injured refused to be interviewed. According to his attorney Ya'agov Rehet, he is afraid of reprisals or of being fired. Experts were not able to estimate with any precision the damage that he can expect in the future. Dr. M. Me'or, who determined that the technician is now almost an invalid, has left the country since. During his testimony at the trial the technician said that that had not been the only time he had been exposed to radioactive radiation. He said that even before the occurrence in question, he and two other workers had been exposed to radiation. Despite that exposure, he had continued to work as a senior nuclear technician. In his claim, the technician charged that state negligence and drawbacks, through the performance of his work superior, were responsible for the accident and its consequences.

Initially, the representative of the general attorney rejected that accusation on behalf of the state. However, he amended his position in the course of the trial. Ya'agov Tirkel, the judge of the Be'er Sheva District Court determined in his verdict that "A money grant should be awarded to compensate for all the distress, damage, and dangers that have been suffered or may possibly occur in the future." He decided that the state should pay 50,000 shekel to the nuclear technician from Holon, as well as the fee for the technician's attorney, which came to 7,500 Shekel.

12782

CSO: 5100/4523

COURT APPOINTS TRUSTEE FOR CHERNOBYL LAWSUIT

AU221709 Vienna KURIER in German 22 May 87 p 2

[Unattributed report: "Chernobyl Lawsuit: Trustee Appointed"]

[Text] The lawsuit filed by Traude Kofler, head of the Austrian Women's Organization for Disaster Aid (KOeF), to obtain compensation for the effects of the Chernobyl reactor accident was not accepted by the Soviet Union.

Therefore, Vienna lawyer Dr Herbert Michner has now been appointed proxy [kurator] for the USSR. Michner was enjoined to represent the USSR "at its risk and expenses until it either acts for itself or appoints an authorized representative."

Mrs Kofler requests a verdict which puts on record that the USSR is responsible for all the damages which have affected or will affect Kofler as a result of the nuclear accident in Chernobyl on 25 April 1986.

Most likely Kofler will for the time being receive no money from the Soviets with the exception of the payment of court costs, but the court would in this way clarify the liability issue. It must be proved in a court of law that damages have been caused by the Chernobyl accident.

/9274

CSO: 5100/2446

URENCO'S RECORD ON NUCLEAR PROLIFERATION DEFENDED

Rotterdam NRC HANDELSBLAD in Dutch 7 May 87 p 8

[Article by Ministry of Foreign Affairs official F.J.A. Terwisscha van Sceltinga: "Access to Fissile Material Necessitates Better Agreements with Developing Countries: Tension on the Nuclear Market"]

[Text] According to an article recently published in NRC HANDELSBLAD, Eng B. Elzen of the University of Twente is of the opinion that the broadening of activities in the area of uranium enrichment (where he is actually targeting UCN [Ultra-Centrifuge Nederland] in Almelo) ultimately makes the production of atomic bombs easier, to which he adds the not insignificant reproach that the enrichment industry has silently extenuated non-proliferation policy and that Urenco has been an active participant in this. Is this true?

It must be noted first of all that over the course of the years, developing countries (and in particular the most important ones) have become increasingly active in the nuclear domain. This applies in two regards. First, by building nuclear facilities, varying from research laboratories to nuclear power plants to processing plants, whereby, however, lack of financial resources has an inhibiting effect. Secondly, in their ever-expanding involvement in the international trade of nuclear goods by way of deliveries of nuclear know-how and materials to other developing countries.

From the very outset, developing countries have sought not only financial, but also technological and material aid from Western and Eastern suppliers, who, depending on the nature of the request and on other considerations and interests, have again and again faced the question: should this assistance, accompanied by guarantees that it will not be misused, in fact be granted, or should it be made difficult by the imposition of conditions, or even denied?

One answer to this question has been found since 1977 in the guidelines adopted by Western and Eastern countries united in the Nuclear Suppliers Group (NSG) for their nuclear exports. This agreement provides primarily for restraint with respect to the transfer of "sensitive" factories, technologies and nuclear materials.

Since then, these countries have enforced this agreement. However, some Western countries have gone one step further and withheld nuclear goods--

sensitive or not--from countries that have refused to accept, in exchange for these goods, international supervision over all current and future nuclear materials in their domain--thus meaning not only the products delivered.

Bad Blood

This policy of "denial" has not only resulted in a great deal of bad blood from countries in Latin America, Asia and elsewhere, but in some cases has even promoted a policy of nuclear self-sufficiency, oriented towards obtaining access to independent know-how and resources for the complete fission cycle as quickly as possible, but without any international control and inspection.

All of this has in turn contributed to an sharp increase in developing countries and other states (who are not members of the NSG) on the nuclear export market. One important question here is whether--and if so, then to what extent--these newly-emerging suppliers are willing to subject their nuclear exports to substantial non-proliferation requirements, and whether it should not be feared that a sort of shadow regime will emerge here, characterized by variable and weak non-proliferation norms.

In light of these developments, which could activate the potential for an alarming degree of nuclear arms production in certain regions, dependant in part on broader international and geopolitical considerations and interests, the question is not whether control over nuclear developments has been lost (as Elzen appears to suggest despairingly), but rather whether it is possible to bring about a meaningful dialogue between Western and Eastern suppliers on the one hand and the "new" nuclear countries in Latin America, Asia and Africa on the other hand.

This dialogue would have to focus on drawing up international agreements on nuclear exports and non-proliferation that would serve both the interests of the national nuclear energy supplies and of regional and worldwide security. This is a decidedly difficult task that will demand a great deal of effort in the years ahead, from the Netherlands as well. Its pursuit is at any rate more sensible than fostering the illusion that countries such as India and Argentina will relinquish nuclear energy and that these developments will in the long run be averted on their own.

Proliferation

Consequently, the more specific question is how much control there is over the proliferation of enriched uranium throughout the world. Elzen says that his outlook can only be a dismal one (even putting forth the false suggestion that the activities of Urenco and UCN in Almelo are contributing in particular to this proliferation).

Looking at the spread of enrichment technology throughout the world, it can be noted that the Western governments in whose countries enrichment facilities are located have from the very outset refused to export that technology in accordance with the NSG agreement. Even Urenco has not done so with its ultracentrifuge technology; this would in fact require the authorization of

the three governments responsible for it, those of Great Britain, the FRG and the Netherlands.

The fact that a number of countries that are not party to the Non-Proliferation Treaty, such as South Africa, Pakistan and Argentina, have at their disposal enrichment facilities (for the most part on a modest scale) can be largely attributed to the efforts made by these countries, even if different means were employed for obtaining know-how and materials from abroad. Without wishing to underestimate the significance of these installations, which are not subject to international supervision--and quite on the contrary--I feel that it is nonetheless an exaggeration to conclude that developments in this area are thus getting out of hand.

The international market has such an ample supply of enriched uranium that a further expansion of the number of enrichment facilities, at least in terms of business management and commerce, cannot be expected directly. In this regard, we are in fact facing a non-problem. If one looks at the export of enriched uranium itself (destined for fuel rods in nuclear power plants), then it becomes clear that international trade, transport and application of enriched uranium (in reactors) is to a very significant degree under the supervision of the International Atomic Energy Agency (IAEA) in Vienna.

It is useful here to note that around 96 percent of all civilian nuclear installations and materials in the world (outside the five states with nuclear arms) is controlled by the IAEA for exclusively peaceful use. There is in fact no possibility of there being an unruly second-hand market, the existence of which Elzen seems to take as a given, even though secret or illegal transactions can never be precluded entirely. These transactions underscore the need for measures to strengthen and refine protection of and control over international transports of nuclear materials. Work is being done on this within the framework of the IAEA.

The allegation that Urenco has been involved in silently extenuating non-proliferation policy is a charge for which Elzen has provided not one bit of explanation or evidence. It is preposterous. It is not Urenco that determines whether non-proliferation requirements are being complied with in every export of enriched uranium from Urenco plants to any country, but rather the regularly convening Joint Commission of government officials from the United Kingdom, the FRG and the Netherlands. Among other things, they provide for a strict application of the Viennese safeguards in exports to states without nuclear arms.

None of the thresholds are lowered for the sake of commercial profits; all of the Urenco uranium is subject to controls.

This is perhaps a good place to correct a constantly recurring perception, namely that the purpose of international measures for control and inspection is to prevent the misuse of nuclear material for the production of nuclear arms. This is not the case. The purpose of these measures is to make it possible to discover at an early stage that significant quantities of this material are possibly being taken out of peaceful nuclear activities and used for the purpose of arms production.

The prospect of discovery serves as a "deterrent" to redirected use. These control and inspection measures thus promote confidence among neighboring states to the effect that that which has been declared to be peaceful in a particular country is in fact just that, and will remain so.

The Viennese system of safeguards clearly has its shortcomings, but is at the same time the object of improvements, adaptations and modernization, including those involved with the most modern equipment and technologies. It functions according to principles, methods and targets established through agreements with countries and in its elaboration is custom fit to all conceivable strategies--according to the respective type of nuclear facility--for (clandestinely) removing nuclear material from their declared peaceful goals. The probability that any redirection of use will be discovered is a large one.

Control

Only one year ago, with active Dutch political support and technical contributions by seven countries and the secretariats of Euratom and the IAEA, an international control and inspection system for ultracentrifuge enrichment plants (the Netherlands, Great Britain, the FRG, Japan, the United States) came into being.

This systems provides for adequate guarantees, including the use of unannounced inspections of the cascade halls, so that the illegal removal of material to installations or the upgrading of material within these installations to a higher enrichment grade (thus making it suitable for nuclear arms production) can be detected. This inspection system, which has been worked out in fine detail, guarantees control over misuse of enriched uranium.

Based on an undercurrent of hesitation between acceptance and rejection of nuclear energy in this country, there is also a certain amount of sympathy for arguments that have a critical or negative view of ongoing attempts to resist the spread of nuclear weapons outside the two power blocs.

It is sad that such arguments often falter on their bias and insufficient knowledge of the state of affairs. The problems of non-proliferation are many-sided and complex because they often simultaneously involve political, economic, commercial, technological and scientific aspects and interests. Most of all--and this is not always discerned to an adequate degree--they involve the essential interests of security and stability in (parts of) the world, and thus clearly merit more than rash treatment.

12271

CSO: 5100/2442

BRIEFS

RADIATION LEAK REPORTED AT REACTOR--Brussels, 21 May (ANSA)--A "slight release" of radioactivity was reported Tuesday in the containment chamber of the high flux reactor at the European Community's nuclear research center at Petten, in the Netherlands, the European Commission disclosed Thursday. According to the statement released, "the reactor automatically shut down and no one was exposed to radiation. The accident was caused by a defect in the cooling system at the installation utilized for the manufacture of radio-isotopes for medical purposes, [quotation marks as received] The Commission said that Dutch authorities, informed of the accident, found no irregular readings of levels of radioactivity outside the plant. The reactor should be brought back on stream Friday. [Text] [Rome ANSA in English 0805 GMT 22 May 87 AU] /9274

CSO: 5100/2445

AGENCIES EXCHANGE CHARGES OVER RADIOACTIVE CONTAMINATION

Istanbul MILLIYET in Turkish 26 Feb 87 p 7

[Nilgun Tarkan report]

[Text] Ankara--The dispute over radioactive contamination of tea assumed new proportions with the publication in MILLIYET of Turkish Atomic Energy Agency President Ahmet Yuksel Ozemre's acrimonious letter to the Middle East Technical University [METU].

The Vice President of METU, Professor Okan Tarhan, declared that the letter contains "regrettable expressions" and added that "there cannot be two correct answers in exact sciences." Atomic Energy Agency President Ozemre replied: "I do not want to engage in polemics. I will not comment."

University circles described Professor Ozemre's posture as "unscholarly." In his letter, Professor Ozemre accused METU faculty members with lying and used expressions such as "common" and "vulgar."

In his letter, Ozemre accused METU experts who prepared the report on radioactive contamination of tea as follows:

"The eagerness to use science for a common and vulgar purpose such as trying to alarm the people under the guise of scientism can cause panic among pregnant women and may result in the prenatal death of numerous babies. That not only dishonors the so-called scientists who authored this report, but also constitutes a great misfortune for METU."

Professor Ozemre's reference to the METU experts as "so-called scientists" and his statement "we are deeply dismayed by the presence of such malicious individuals in METU" implying that the university administration should terminate the faculty members who prepared the report caused widespread resentment.

METU's Reaction

In a statement to MILLIYET, METU Vice President Okan Tarhan said that Professor Ozemre's letter contained "extremely regrettable expressions." Stating that he does not wish to level any accusations against any agency and

that the university would rather get over with this dragging controversy. Professor Tarhan said that he expects Minister of Industry and Trade Cahit Aral to issue a statement to end the dispute.

Stating that he is confident about the accuracy of the METU research, Professor Tarhan said: "There cannot be two correct answers in exact sciences." Declaring that his organization never deviated from scientific methods, Professor Tarhan said that the research revealed elements which may imperil public health.

Ozemre: 'I Will not Comment'

In an interview with the HILLIET correspondent Atomic Energy Agency President Ozemre simply said "no comment" despite insistent questioning. Ozemre, who has not been answering even phone calls at the urging of the Minister of Industry Aral, was interviewed in his office by the HILLIET correspondent. When asked whether "the expressions used in his letter are still valid" Ozemre replied: "I do not want to engage in polemics. I will not comment."

YOK: 'We Did not Impose Bans on Speech'

The President of YOK (Higher Education Council), Professor I. Tarhan, disclosed that it was not YOK which imposed a ban on the publication of university research work on radioactive contamination.

Professor Tarhan stated that a letter signed by Minister of Industry and Trade Cahit Aral and sent to YOK requested that no results on measurements and effects of radiation in Turkey be published without the prior knowledge and approval of the Turkish Radiation Safety Committee. He added that YOK forwarded this letter--which was received last August--to the universities.

Scientific Circles' Views

Professor Ozemre's letter has caused general dismay and resentment among scientific circles. Scholars expressed the following views to HILLIET on this issue:

Professor Mehmet Kalkan (former President of METU): "No one should censor scholarly research conducted by faculty members. I find the assault on the scholarly competence of METU unpleasant and improper. Members of the METU Alumni Association include ministers and undersecretaries. These individuals will probably be upset as well. Another important issue is how can a blackout imposed by YOK on an issue as vital as radioactivity be squared with academic autonomy."

Professor Feridun Ergin: "This controversy smells of politics. It is the result of negligent acts by those in charge. In foreign countries, studies were undertaken and announcements were made as soon as alarms were sounded about the danger of radioactivity. The turning back of exported goods indicates that the scope of the threat is greater than what was disclosed. Now an effort is under way to suppress criticism by exchanging polemics."

Professor Cetin Ozek: "This controversy is part of the general ins seriousness prevalent in Turkey."

Professor Ugur Alacakaptan: "It is a typical example of orientalism, irresponsibility and ins seriousness."

Professor Tarik Zafer Tunaya: "I believe in the institution of the university. I believe in scholarly research free of official and political pressures. In principle, the university will not and should not bow to this pressure. Consequently, the stance of the university is realistic."

Professor Ahmet Dervisoglu: "An impartial commission must be formed and a scientific study must be conducted disregarding the dispute between METU and the Atomic Energy Agency. In scientific disagreements, the hypotheses put forward must be supported with evidence. The argument of 'you are a liar' is an unscientific posture."

Professor Guray Tuzun: "Scholars have been handcuffed and muted since the establishment of YOK. The present state of affairs is the natural result of developments in Turkey. Academicians are unable to speak up on economic and political issues. The recent developments are dismaying."

9588

CSO: 5100/2431

CARGO REFUSED IN UAE, EGYPT FOR RADIATION CONTAMINATION

Istanbul TERCUMAN in Turkish 26 Feb 87 p 3

[Text] Iskenderun/Sharjah--Three Turkish cargo ships carrying goods from Turkey to the United Arab Emirates [UAE] and Egypt have been turned back on grounds that they were carrying radiation-contaminated products.

An official statement issued in UAE said that the 214,000 metric tons of animal feed aboard an unidentified ship was found to contain 5,500 becquerels of radioactivity per kilogram. The statement said that the maximum allowable level of radioactivity in animal feed is 1,000 becquerels per kilogram.

A report in AL-KHALIJ, a paper published in Sharjah, quoted an official as saying that the ship has been seized and that it will be escorted back to Istanbul by Omani and UAE naval ships. The paper added that this measure was taken to ensure that the radiation-contaminated animal feed will not be dumped into the sea.

Egypt Turns Back Ship

Egypt is also reported to have turned back a ship laden with Turkish hazelnuts to Turkey. Another ship laden with Turkish spices was also turned back.

Egyptian Minister of Health Muhammad Duwaydar disclosed that the Egyptian ship carrying hazelnuts from Turkey arrived in Alexandria on 5 February.

Stating that tests conducted on the ship's cargo revealed that the 20 metric tons of hazelnuts "contained above-normal levels of radioactivity," the minister said that the cargo was sent back to Turkey. Duwaydar added that the Egyptian navy will escort the ship until it leaves Egyptian territorial waters.

The Egyptian Minister of Health also disclosed that the Lebanese-registered ship, Juliana, laden with 3.3 metric tons of Turkish spices was also sent back to Turkey.

It is reported that this is the first time radioactive contamination has been encountered in products imported into Egypt, which began inspecting all its food imports for radioactivity after the Chernobyl accident.

Egypt's standard of "normal" radioactivity is 600 becquerels per kilogram which is the same standard used by the EEC.

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